

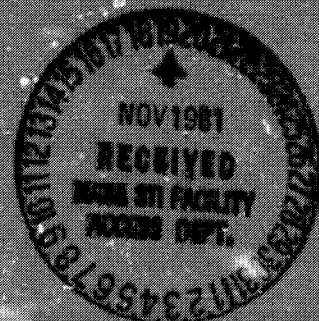
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Final Report No. IITRI-M06055-10

EVALUATION OF THE EFFECTS OF SOLAR
RADIATION ON GLASSES

National Aeronautics and Space Administration
George C. Marshall Space Flight Center
Marshall Space Flight Center,
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Attention: Mr. R. L. Nichols, EH-34

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August 1981


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FOREWORD

The work described in this final report, IITRI-M06055-10, entitled "Evaluation of the Effects of Solar Radiation on Glasses," was performed under the sponsorship of the Marshall Space Flight Center. The work was conducted under Contract No. NAS8-33388 over the period July 9, 1979 to December 31, 1980, at IIT Research Institute. Mr. Y. Harada was the principal investigator on this program. We are pleased to acknowledge the valuable assistance and counsel of Mr. R. L. Nichols, NASA/Marshall Space Flight Center Contracting Officer's Representative on this program.

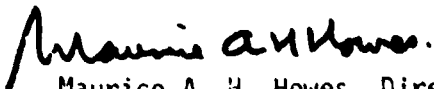
Respectfully submitted,

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1. INTRODUCTION

The space environment to be encountered by space vehicles is extremely complex, involving particulate as well as ultraviolet radiation. The penetrating radiation environment may result from a variety of sources of which the most important are probably cosmic radiation, trapped radiation, auroral radiation, and solar flare radiation. It is possible that such high energy protons and electrons will have a more significant effect than ultraviolet on spacecraft materials such as glasses, and that synergistic effects from the variety of radiations will occur.

A wide variety of functions must be performed by glass components on a space structure, ranging from windows for simple viewing in the visible wavelength region, to lenses for ir detection devices which must transmit at much higher wavelengths. Thus, radiation damage must be evaluated with a view toward the particular application. For example, many infrared-transmitting materials have been darkened to near opaqueness in the visible region, but the ir transmission remains virtually unaffected so that the functionality is maintained.

In a recent program conducted at IITRI,¹ studies were conducted to evaluate the degradation of glass due to electromagnetic and particulate radiation in a space environment. Initial work was concerned with attempts to define the space environment. Secondly, a literature review was made on radiation damage mechanisms in glasses. Four optical materials were exposed to simulated solar and particulate radiation in a space environment. Sapphire and fused silica experienced little change in transmittance while optical crown glass and ultra low expansion glass darkened appreciably.

The objective of the current program was to carry this technology further by achieving a more complete analysis of the 500 hour simulated space exposure test. Additionally, studies were conducted to aid in sample selection for a 100 hour simulated exposure test.

2. TECHNICAL BACKGROUND

Current materials for space applications must endure increasingly stringent environments as missions are displaced outward from near-earth orbits, and are designed for longer durations of several years. In a synchronous equatorial orbit, for example, electrons and protons as well as ultraviolet radiation are considered to be prime contributors to spacecraft surface materials degradation.² The ramifications for glass materials are discussed in the following sections.

2.1 SPACECRAFT OPTICAL MATERIALS

The materials used aboard spacecraft for optical applications are in general those which transmit in the solar spectrum, nominally from 200 nm to 3000 nm. For the 200-1000 nm regions, silicon oxide based materials, notably fused silica of high purity, have found widest application. The selection of suitable optical materials, however, involves not only initial optical properties, but optical stability, mechanical properties and performance, contamination potential, contaminability, electrical properties, rf transparency, and, of course, cost.

From a materials point of view, there are three regions of optical interest: UV (<300 nm), visible (300-700 nm), and near ir (>700 nm). For UV applications, silica appears optimum, although some alkali halides might be considered; in any UV applications, inorganic materials are almost mandatory. Visible region applications quite probably can utilize organic-based transparencies, except there UV transparency is also essential. Infrared applications--both traditionally and, quite logically, from materials initial properties and space stability considerations--have required inorganic materials. Organic materials inevitably exhibit either ir "fingerprint" spectra, poor mechanical properties, or other objectional properties. Simply stated, the primary criteria for selection of spacecraft optical materials are initial properties, environmental stability, and mechanical/physical/environmental considerations. Only one region, the visible, was investigated on the IITRI

program, and the materials were all inorganic oxides.¹ These are discussed in a later section.

For spacecraft use, in general, standard radiation resistant optical materials are sapphire and Corning 7940 fused silica glass. These are used for the front elements of optical systems whenever possible. If other materials must be used, a 2-3 mm thick fused silica glass window is used in front of the optical components. The window eliminates almost 90% of the particulate radiation and also the very short wavelength ultraviolet. If a window cannot be used, then the equipment is designed to compensate for the degradation. For example, solar cell cover glass, Corning 0020, degrades approximately 5% in one year when exposed directly to solar radiation. Hence, for a one-year mission, the cell is designed to have an initial output which is 5% greater than required.

2.2 SPACE ENVIRONMENT DEFINITION

The highly complex and dynamic nature of a space environment demands in-situ and current data for good definition. This type of information is best obtained from a source such as the Goddard Space Flight Center which continually monitors and analyzes such data. IITRI in its previous program established a dialogue with Mr. E. G. Stassinopoulos, Senior Acquisition Scientist, Radiation Environment, NASA/Goddard Space Flight Center.

Mr. Stassinopoulos pointed out that the space environment near the earth was extremely variable, both spatially and temporally. Photon radiation remains relatively constant at 1 sun, but particulate radiation, which is mainly protons and electrons, strongly depends on the orbit of the spacecraft and the solar activity during the time in orbit.

The space environment in which the glasses are to be used was also discussed with Mr. R. Nichols and Mr. J. Wright, Astrophysics, and with Mr. P. Priest, Space Programs, NASA/Marshall Space Flight Center.

The conclusion from these discussions was that average conditions should be selected for initial simulated solar radiation experiments. Later experiments could then be designed to explore the effect of variations from average.

3. RESULTS AND DISCUSSION

The current program was concerned with evaluation of a space simulation test of optical materials for spacecraft and with determination of materials anticipated for use in future space missions. The results are discussed in the following sections.

3.1 GLASS MATERIALS

In current technology, sapphire or fused silica glass appear to be the best materials available for resisting optical degradation in an ultraviolet/particulate radiation environment. In establishing glass materials for testing the following ranking of resistance to radiation damage was developed:

1. Excellent - sapphire
2. Good - fused silica
3. Fair - optical crown glass
4. Poor - ultra low expansion glass

These materials were chosen for exposure for the following reasons:

1. Sapphire is exceptionally strong and hard (9 on the Mohs scale) and is by all reports the best material for resisting radiation damage. Union Carbide Czochralski grown sapphire crystals were chosen.

2. Fused silica is a close second to sapphire in strength and hardness (7 on the Mohs scale) and in radiation resistance, and has been used on numerous space missions. Corning 7940 synthetic fused silica was chosen because it is a well-characterized, uniform material with very low solar absorptance.

3. Optical crown glass is used in many optical devices as the front element of the objective lens. It was observed to darken when exposed directly to the space environment in Spacelab experiments. Shott BK-7 was chosen since it is the most widely used glass of this type and readily available.

4. Ultra low expansion glass is a very interesting optical material which is almost immune to thermal shock failure. Windows made of this material could be used without failure for observation during the thermal heating caused by reentry. Corning 7971 was chosen because it was readily available.

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Specimens were obtained directly from the manufacturer. The sapphire specimens were obtained from the Crystal Products Division of Union Carbide Corporation as standard optical windows, 25.4 mm diameter and 2 mm thick. The optical glass specimens were also standard windows, 25.4 mm diameter and 3 mm thick, obtained from Melles Griott, Inc., Irvine, California. The fused silica and ultra low expansion glasses were obtained from the Corning Glass Works as rough cut discs which were then ground and polished to 25.4 mm diameter and 3 mm thick.

All the specimens were made of commercially produced materials. Standard industrial pitch polishing procedures were used to produce specimens which were flat within 1/4 wavelength of light per 25 mm, parallel within 30 seconds of arc, and surface quality of 80-50 scratch and dig.

Samples were cleaned, and approximately one half of the surface of each sample was coated with aluminum and then with silica by vacuum evaporation. The coating provided a back surface mirror for transmission optical measurement by double reflection.

The samples of the selected glasses were furnished to Boeing Aerospace Corporation, who conducted the simulated exposure. Brief descriptions of the glasses, the number of specimens supplied, and the number of each type put into the exposure array, are indicated in Table 1.

TABLE 1. WINDOW MATERIALS FOR SPACE SIMULATION STUDIES

Glass Type	Number Supplied	Number Tested
7971 (low expansion glass)	3	2
BK-7 (crown glass)	3	2
7940 (fused silica)	2	1
Sapphire (alpha-alumina)	2	1

3.2 TEST SIMULATION CONDITIONS

Test irradiation parameters were determined on discussions with NASA/Marshall and NASA/Goddard personnel, and were as follows:

1. Solar UV--one sun intensity, assuming earth orbit and air mass zero conditions; 0.2 to 0.4 micrometer spectral content from xenon arc continuum; infrared $\lambda > 1.4$ micrometer suppressed by water column around xenon arc.
2. Vacuum UV--one sun intensity at hydrogen Lyman- α wavelength (1216 Å); radiation introduced into chamber through the VUV source's window.
3. Electrons--intensity (flux) 1×10^9 e/cm²-sec, at 50 KeV energy.
4. Protons--intensity 1×10^9 p/cm²-sec, at 30 KeV energy; introduced into chamber after magnetic bending to separate mass-one (H^+) from H_2^+ and other species.
5. Temperature--20°C for all test samples.
6. Vacuum--average of at least 5×10^{-8} torr during exposure, and 2×10^{-8} torr during spectral reflectance measurement periods.

3.3 TEST SIMULATION FACILITIES

The space simulation test was conducted at the Boeing Aerospace Corporation. A description of their facilities is presented in Appendix A. During the course of this program, a visit was made to the facilities at TRW in Redondo Beach, California. A tour of the space environmental systems laboratory was made through the courtesy of Mr. G. Brown. These laboratories are described in the literature in Appendix B.

3.4 SPACE SIMULATION EFFECTS ON GLASSES

Examination of the specimens immediately after 503 hours of exposure showed that the optical glass and ultra low expansion glass specimens had darkened appreciably. All specimens were physically intact after exposure and had not suffered any gross mechanical damage. Heating and charge buildup during exposure was probably very small, since the specimens were in good thermal and electrical contact with the water-cooled copper support.

Graphs of the absolute reflectance data for representative specimens are shown in Fig. 1 (sapphire) and Fig. 2 (low expansion glass). In each of these figures the uppermost data curve was obtained before exposure began. Small reflectance changes were measured at each subsequent measurement point, with the 503-hour data being represented by the lowest curve. Tabular data of reflectance values vs. wavelength for the various samples at the different levels of exposure are contained in Appendix C.

The computer program also calculated solar absorptance coefficients (α_s) corresponding to each measurement. These are tabulated below.

TABLE 2. SOLAR ABSORPTANCE CHANGES IN SPACE SIMULATION STUDIES

Sample	Solar Absorptance Coefficient					
	Pre-Irrad in Vacuum	After Exposure for				Increase After 503 hr
		50 hr	154 hr	313 hr	503 hr	
Sapphire	0.109	0.112	0.110	0.115	0.118	0.009 (8.3%)
Crown No. 3	0.094	0.106	0.109	0.114	0.118	0.024 (25.5%)
Crown No. 2	0.098	0.109	0.111	0.117	0.119	0.021 (21.4%)
Low exp. No. 1	0.085	0.092	0.094	0.101	0.108	0.023 (27.1%)
Low exp. No. 2	0.083	0.088	0.090	0.097	0.108	0.020 (24.1%)
Fused Silica	0.078	0.080	0.081	0.088	0.087	0.009 (11.4%)

The change in the absorptance of the sapphire and fused silica specimens was very small and close to the limit of accuracy of the measurements.

A plot of these α_s values against exposure time (Fig. 3) shows that sapphire and fused silica have no pronounced initial increase in α_s but, rather, have a somewhat regular α_s increase rate. On the other hand, the

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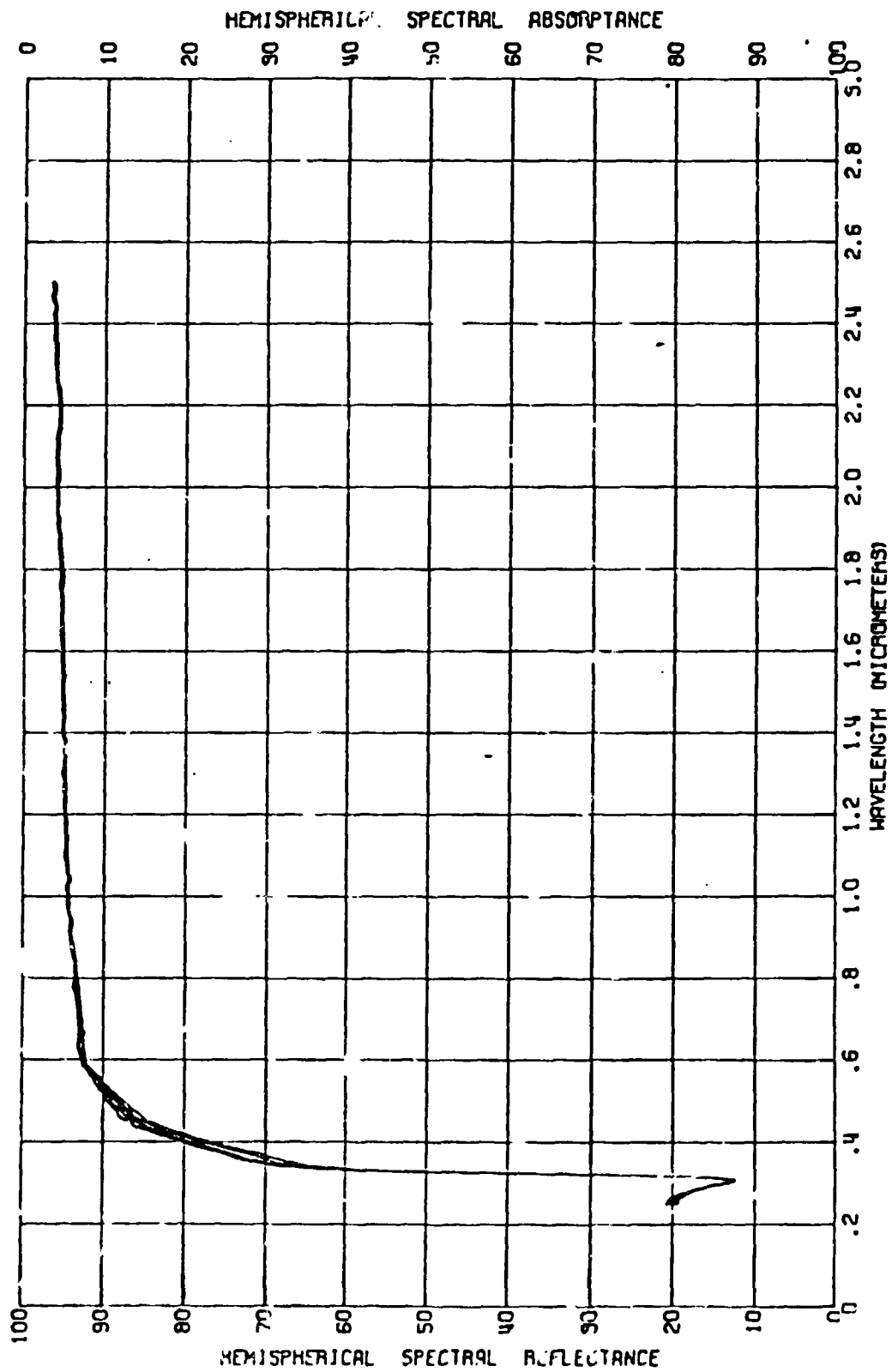


Figure 1. Effect of real-time solar UV, vacuum UV, protons, and electrons on the reflectance of sapphire in situ.

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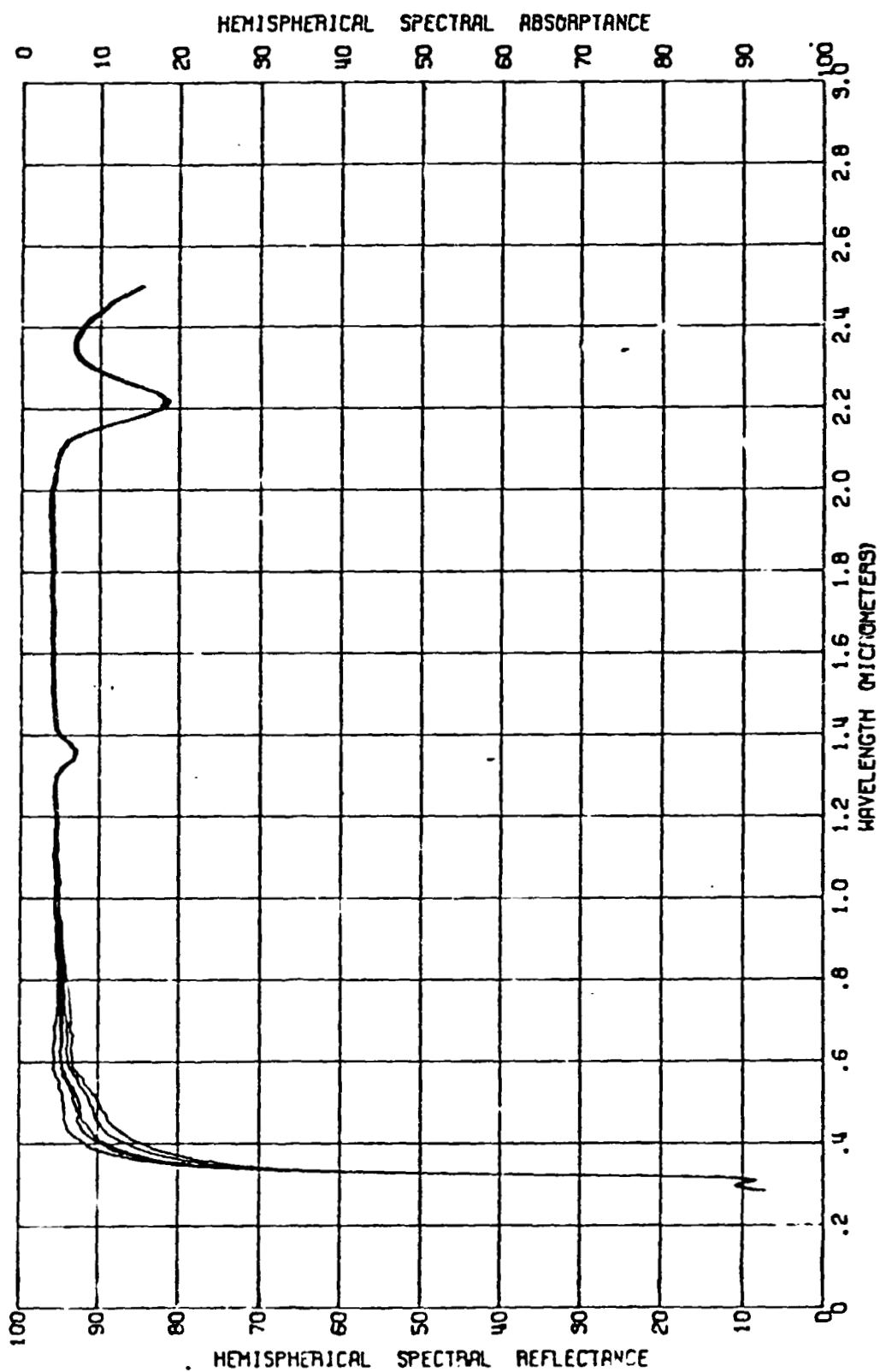


Figure 2. Effect of solar UV, vacuum UV, protons, and electrons on the reflectance of 7971 low expansion glass in situ.

crown glass samples and the low expansion glass samples underwent larger initial increases in α_s that tapered to slower rates of increase.

Examination of the reflectance curves before and after various exposure times did not reveal the appearance of any new absorption regions. Rather for all specimens there was an increase in absorption with exposure time, particularly at the fundamental absorption edge in the near UV. Examination of the more detailed digital data in Appendix C, also did not reveal any particular pattern in reflectance changes. The absorptions at 1.3 and 2.2 micrometers of the glasses relate to the silica network and was most pronounced in fused silica. Sapphire being alumina did not, of course, show these. It was surprising that the modifiers present in the optical glass and ultra-low expansion glass did not result in new absorptance regions after exposure, although they do suppress the silica regions in optical glass.

The change in solar absorptance values with time which was tabulated in the previous section and shown in Fig. 3, indicate that the *a priori* ranking of the optical materials was correct. Sapphire is the most stable material followed closely by fused silica, while crown optical glass and ultra-low expansion glass show stronger degradation. For some applications fused silica may be preferred because of its lower initial absorption, since even after 503 hours of exposure it was still less than sapphire. The optical glass and ultra low expansion glass, on the other hand, while reasonably stable for 503 hours, may have limited usefulness for very long space missions. However, the utility of any optical materials will be determined by the particular mission requirements.

Other analytical methods which were examined were thermoluminescence and changes in microhardness. The measurement of microhardness was used in an attempt to determine any change in mechanical integrity. No significant differences were observed for exposed (500 hr simulated exposure) vs. virgin materials. Apparently this test is not sensitive enough to show changes (if any) in the bonding of these glasses. Thermoluminescence measurement was thought to be another potential analytical method. However, it was determined that the assembly of the needed equipment, along with performing of such experiments, was beyond the financial scope of this program.

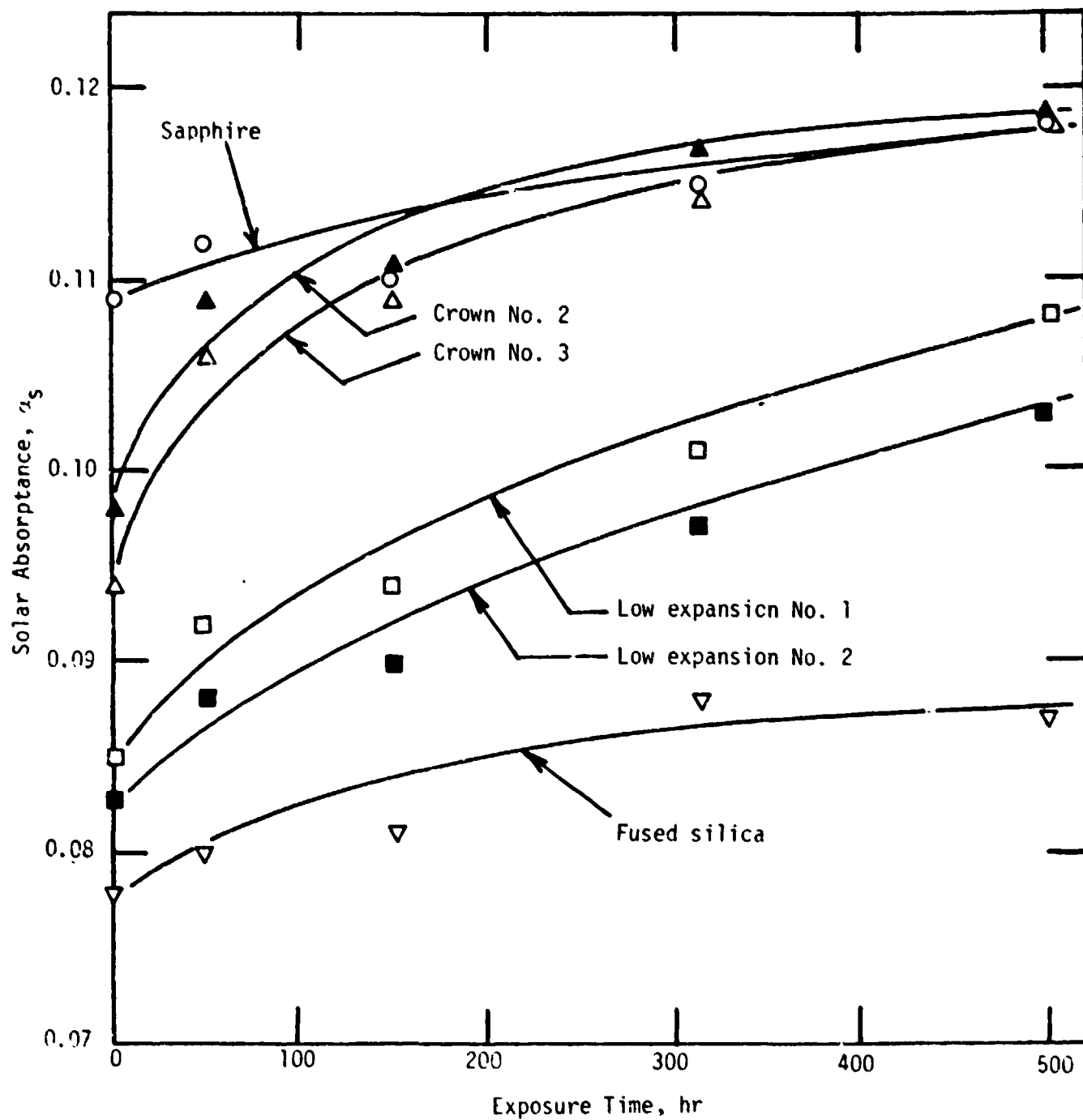


Figure 3. Solar absorptance vs. exposure time to simulated space environment for glass materials

3.5 SPACECRAFT GLASS MATERIALS: STATE-OF-THE-ART

Dialogue with engineers involved with spacecraft materials was carried on during this program. People who have been contacted include: Bill Carroll (JPL), Carl Maag (JPL), Larry Fogdall (Boeing), Gene Rusert (McDonnell Douglas), Mel Clancy (Rockwell), Al Rubin (Aerojet), and Jerry Brown (TRW). The consensus appears to be that fused silica is acceptable for all current missions including those in synchronous orbit. Problems or potential problems of any significance with glass materials have not yet surfaced.

Examples of glass material laminates used for viewing windows in spacecrafts are shown in Fig. 4. This information was supplied by Mr. G. Rusert of McDonnell Douglas which was responsible for these spacecraft.

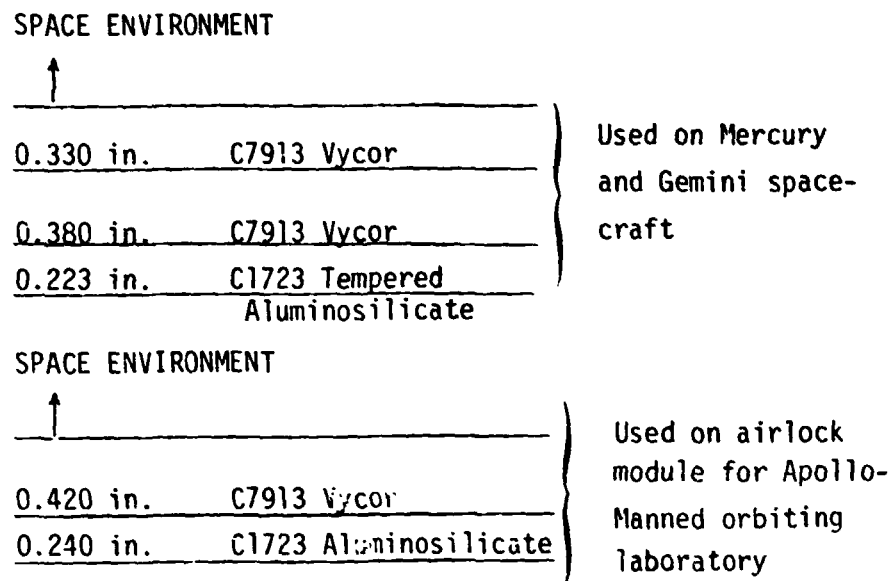


Figure 4. Spacecraft Windows

4. CONCLUSIONS AND RECOMMENDATIONS

Additional studies were conducted in this program in an effort to extract additional information from the results of a 500 equivalent hours space simulation experiment. These studies have shown the following:

1. Changes in reflectance spectra do not show any significant differences in absorption peaks which could be used to indicate degradation mechanisms. It is possible that the test period was too short to produce any such differences.
2. No significant changes were observed in microhardness of glass samples due to UV-vacuum-particulate irradiation.
3. Longer term testing is needed in order to obtain information applicable to longer term space missions of up to 10 years.
4. Fused silica and "Vycor," a high-silica (96%) glass, appear to be the preferred glass materials for viewing windows on spacecraft. Among the people interviewed with interests in this area, no significant problems were apparent.
5. For any future tests, the Boeing and TRW space simulation laboratories would appear to be significantly different.

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3. Zerlaut, G. A., Harada, Y., and Tompkins, E. H., "Ultraviolet Irradiation in Vacuum of White Spacecraft Coatings," in Symposium on Thermal Radiation of Solids, NASA SP-55, Scientific and Technical Information Division, Washington, D.C., pp. 391-420 (1965).

APPENDIX A

**Radiation Effects Laboratory
Boeing Aerospace Company
Seattle, Washington 98126**

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RADIATION EFFECTS LABORATORY
BOEING AEROSPACE COMPANY

The simulated space exposure for this program was performed in a facility at Boeing known as the combined radiation effects test chamber (CRETC). This facility was originally designed after completion of a number of years of testing thermal control coatings for government and corporate customers. It has as high a quality of simulation of the space radiation environment as knowledge and the state-of-the-art will allow. Exposure capabilities include electron radiation and Lyman- α vacuum ultraviolet sources in addition to the usual proton accelerator and solar simulator.

The space simulation capabilities of the CRETC facility can be summarized as follows:

1. Continuum ultraviolet radiation (xenon arc discharge) at selectable intensities ranging from less than one solar constant to 20 solar constants (1 AU), simultaneously with:
2. Electrons with energies between approximately 10 eV and 200 keV and/or protons with energies from 0.5 to 85 KeV (kilo electron volts). Electrons of greater than ~ 15 KeV are foil-scattered; protons are magnetically analyzed.
3. Vacuum ultraviolet radiation (VUV), primarily the Lyman- α wavelength of 1216 \AA , from a contained discharge (no introduction of contamination into vacuum chamber). Intensity selectable up to and above one VUV sun at 1216 \AA at 1 AU.
4. Controlled temperatures for test and reference (standard) samples; temperatures range from

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-195°C (-320°F) to +180°C (+360°F). Temperature control is not interrupted for measurements in the chamber's integrating sphere.

5. Vacuum pumping (both rough and final) without resorting to organic and other contaminating fluids. The sequence used is (a) dry nitrogen gas aspiration, (b) cryo-sorption, (c) large-surface LN₂ cryogenic, and (d) ion pumping, to obtain a 5×10^{-8} torr vacuum before testing begins.
6. Extensive automation, interlocks, and sequential shutdown procedures during unmanned night-time operations, to allow as high a reliability as possible during long-term, continuous testing.
7. High-precision spectral reflectance data system with in-situ integrating sphere and double-beam spectrophotometer coupled to a data-logging module whose output is ready for computer processing.
8. Residual gas analysis from 1-100 amu with scan rates down to 0.1 sec/scan and minimum partial pressure detectability of 2×10^{-11} torr.
9. Electrical discharge event counter with relative magnitude indication.

The CRETC utilizes an integrating sphere reflectometer with detectors in situ. Only the measurement light sources, monochromator, and electronic and light chopping apparatus are external to the chamber. Sample reflectance measurements are made relative to the reflectance of the integrating sphere's magnesium oxide wall. Normalization to absolute reflectance (derived from National Bureau of Standards and other known reference measurements) is handled by computer since all original sample data are computer-processed routinely.

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The thermophysical property of chief interest for this program, solar absorptance, is derived from solar reflectance, which is defined as

$$\text{Solar reflectance, } R_s = \frac{\int I_s(\lambda) R(\lambda) d\lambda}{\int I_s(\lambda) d\lambda}$$

where $I_s(\lambda)$ is the solar irradiance as a function of wavelength λ , and $R(\lambda)$ is sample reflectance, generally a function of λ . By measuring the reflectance of transmissive glasses with a suitable metal backing (aluminum), double sensitivity to radiation-induced changes is obtained. The measurement beam passing through the integrating sphere makes a double-pass through the sample, yielding a measurement proportional to change in transmission squared. This allowed a more exact determination of damage in the various optical quality glasses studied and compared during this program. In practice, change in transmission generally will be found to be half the measured change in reflectance.

Radiation dosimetry systems are integral to the CRETC, and operating personnel have long-time experience in obtaining the pertinent irradiation and exposure parameters. Faraday cups and tabs are both employed for measuring oncoming particle radiation beams at the sample plane.

For ultraviolet radiation parameters, sun rates are determined from radiometer output levels taken with and without a UV-absorbing filter over the radiometer detector. Since the UV-absorbing filter also excludes ten percent of the incident radiation at wavelengths longer than the ultraviolet (five percent reflection at each surface of the filter), a correction is made for radiometer readings taken with the filter over the radiometer sensor. For a total radiation reading T and a UV-filtered reading F ,

$$\text{Ultraviolet Sun rate} = \frac{T - \frac{10}{9} F}{(8.0) (0.091)} = 1.37 (T - 1.11 F),$$

where 8.0 is the radiometer sensitivity in millivolts per incident sun (≈ 0.14 watts/cm²) and 0.91 represents the ultraviolet content of the sun (at air mass zero). The uniformity of ultraviolet radiation intensity across the sample array is determined by "mapping" with the radiometer held in a precise jig.

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Spatial uniformity of ultraviolet radiation can be maintained within plus or minus 10 percent across the sample array. The F and T values indicate that the ultraviolet content of the long-arc xenon sources is approximately 10 percent of their total input. Characteristic of all xenon arcs, the shape of this ultraviolet content is somewhat more steep than the sun at air mass zero (AM0).

APPENDIX B

**SPACE ENVIRONMENT SIMULATION LABORATORY
TRW Defense and Space Systems Group
Redondo Beach, CA 90278**

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TRW - DSSG
SPACE ENVIRONMENT
SIMULATION LABORATORY

TRW DSSG-Vulnerability and Hardness Laboratory of the Advanced Technology Division in conjunction with the Engineering Laboratory of the Space Systems Division operates a Space Environmental Systems Laboratory for the use of external as well as in company users.

The laboratory is located in TRW DSSG *BUILDING 84* at 14520 Aviation Boulevard, in Lawndale, California in close proximity to the main TRW DSSG complex in Redondo Beach, California.

The original design of this laboratory was primarily directed towards the study of optical and mechanical property degradation of relatively thin film materials, solar cells, and other structural elements of spacecraft directly exposed to the natural space environment.

A view of the laboratory in one configuration is shown in *Figure 1*. A number of vacuum irradiation stations/chambers are arranged around a 1.2 MV Van de Graaff electron accelerator in an irradiation vault. The electron beam from the accelerator can be directed into each of the chamber positions using a switching magnet and solenoidal focusing magnets. Each chamber is provided with additional simulation sources for simultaneous operations. The diversity of these sources is tabulated in *Table I*. *Table II* shows the capabilities which presently exist at each chamber position.

Each chamber has an available capacity of 18 inches diameter by 30 inches long. All are pumped by at least 400 l/sec vacuum pumps. The "in-situ" optical chamber and "ex-situ" mechanical test chamber are also pumped by titanium sublimation pumps. The chambers can be easily modified for other types measurements because of the large number of instrumentation/entry ports available on each.

Figure 2(a) and *(b)* gives the simulation spectral capability of the ultraviolet sources in use. As listed in the table the "near" ultraviolet capability is available presently for all three chambers while the far ultraviolet capability is available only at the 60° position.

The laboratory is designed for continuous semi-automated operation. At present all systems and environments can be operated unattended except the Van de Graaff system which is being modified to allow unattended operation of it as well. During such operations key parameters are checked periodically and the latest data is available for remote telephone readout on demand. Out of limit key parameters can be alarmed to a central security system from whence repair personnel can be located immediately by beeper.

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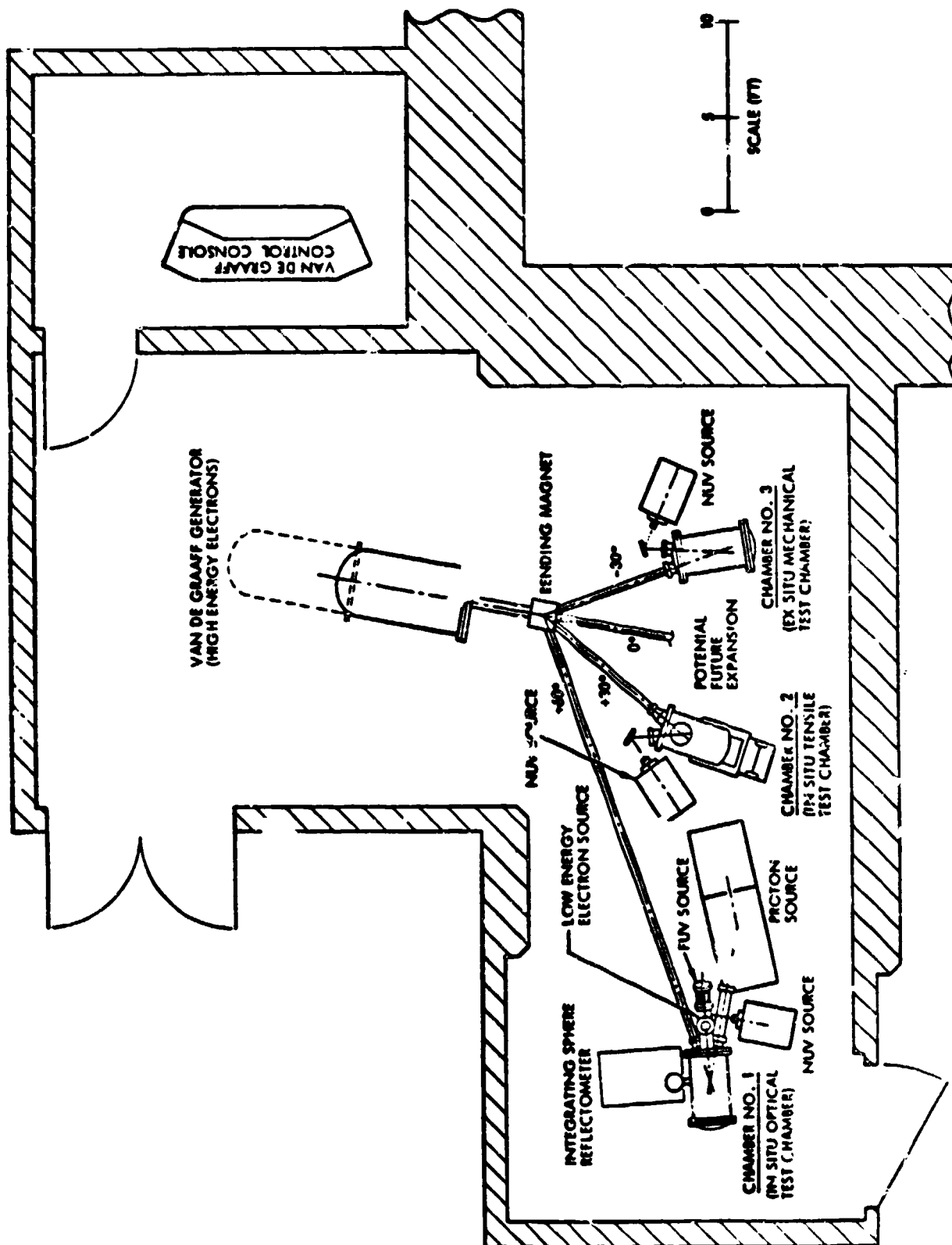


Figure 1 - SPACE ENVIRONMENTAL SIMULATION LABORATORY (SESL) LAYOUT

Table I - ENVIRONMENTAL SIMULATION DESCRIPTION

Radiation Component	Simulated Radiation Source	Simulation Source Characteristics
Near Ultraviolet	3-KW Short Arc Xenon Lamp	0.18 to 0.40 μm Up to 5X Sun Intensity
Far Ultraviolet	Electrodeless Krypton Gas Lamp	0.10 to 0.18 μm Up to 5X Sun Intensity
Radiation Belt Electrons	Van de Graaff Accelerator	50 keV to 1 MeV 10^7 to 10^{11} e/cm ² sec
Plasma Sheet Electrons	Electron Flood Gun	0.5 to 10 keV Up to 10^{11} e/cm ² sec
Radiation Belt Protons	Ionization Equivalent Electrons From Van de Graaff Accelerator	50 keV to 1 MeV 10^7 to 10^{11} e/cm ² sec
Solar Flare Protons	Ionization Equivalent Electrons From Van de Graaff Accelerator	50 keV to 1 MeV 10^7 to 10^{11} e/cm ² sec
Plasma Sheet Protons	Hydrogen Ion Plasma Generator	Up to 30 keV Up to 10^{11} p/cm ² sec
Vacuum	GN ₂ Aspiration, Cryosorption, and 400 l/sec Ion Pumping	10^{-6} to 10^{-8} Torr

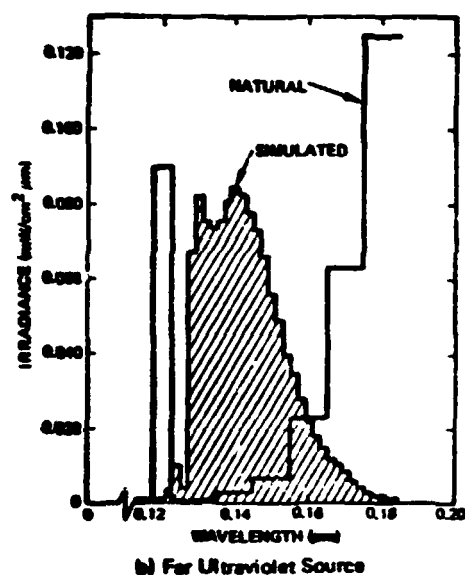
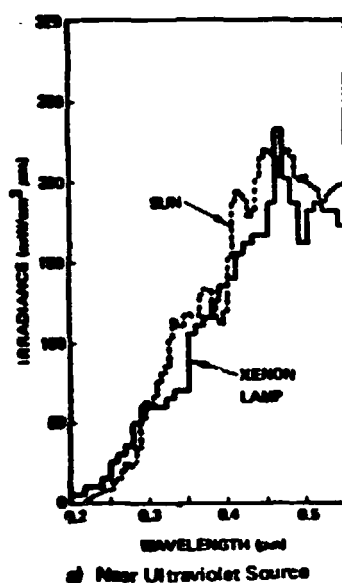


Figure 2 - SPECTRAL ENERGY DISTRIBUTION OF ULTRAVIOLET SOURCES

Table II - LABORATORY CAPABILITIES

Test Station	Environment	Sample Capability	In-Situ Measurement
In-Situ Optical (60°)	Ultraviolet (0.10-0.40 μ m) Protons (1-30 keV) Electrons (1-10 keV) Electrons (50-1000 keV) Vacuum (to 5×10^{-8} T) Temperature (to -100° C)	24 pc (1x2 cm) 4 contamination witness plates	Dir. Spectral Reflectance Dir. Diffuse Reflectance Bidirectional Reflectance Specimens removed for total emittance measurements.
In-Situ Tensile (30°)	Ultraviolet (0.18-0.40 μ m) Electrons (50-1000 keV) Vacuum (to 5×10^{-8} T) Temperature (to -70° C)	17 pc (1 in. gage length by $\frac{1}{4}$ in. width)	Tensile Stress-strain to 2% strain level. Tensile Stress-strain to failure.
Solar Cell Test (0°)	Electrons (50-1000 keV) Temperature (to -20° C)	12 pc (1x2 cm)	Specimens removed for characteristics testing.
Ex-Situ Mechanical (-30°)	Ultraviolet (0.18 to 0.40 μ m) Electrons (50-1000 keV) Vacuum (to 5×10^{-8} T) Temperature (to -100° C)	40 pc (1 in. gage length by $\frac{1}{4}$ in. width)	Specimens removed to dry nitrogen for tensile testing.

Additional information may be obtained by calling R. Kurland- 213/535-1016 or
W. Beggs- 213/536-3135.

Tours of the facility can be arranged through the Building Operations Manager,
P. Guilfoyle- 213/535-0056.

APPENDIX C

REFLECTANCE VS. WAVELENGTH DATA
500 Hour Space Simulation Experiment

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FIGURE 1. EFFECT OF REAL-TIME SOLAR UV, VACUUM UV, PROTONS, K=3
ON THE REFLECTANCE OF BK-7 CROWN GLASS IN SITU IN VACUUM, BEFORE EXPOSURE

HEMISPHERICAL SPECTRAL REFLECTANCE			V ₂ WAVELENGTH			ALPHA(°) = 0.098			
WAVELENGTH (λ _{MBDA})	F(λ _{MBDA})	WAVELENGTH (λ _{MBDA})	F(λ _{MBDA})	WAVELENGTH (λ _{MBDA})	F(λ _{MBDA})	WAVELENGTH (λ _{MBDA})	F(λ _{MBDA})	WAVELENGTH (λ _{MBDA})	F(λ _{MBDA})
0.230	0.0	0.232	0.0	0.234	0.0	0.236	0.0	0.238	0.0
0.240	0.0	0.242	0.0	0.244	0.0	0.246	0.0	0.248	0.0
0.250	6.0	0.252	6.0	0.254	6.0	0.256	6.0	0.258	6.1
0.260	6.0	0.262	6.0	0.264	6.0	0.266	5.9	0.268	5.9
0.270	6.0	0.272	5.9	0.274	5.8	0.276	5.7	0.278	5.7
0.280	5.7	0.282	5.7	0.284	5.7	0.286	5.6	0.288	5.6
0.290	5.7	0.292	5.7	0.294	5.7	0.296	5.6	0.298	5.9
0.300	6.0	0.302	6.2	0.304	6.2	0.306	6.3	0.308	6.6
0.310	6.7	0.312	7.0	0.314	7.7	0.316	8.8	0.318	10.7
0.320	13.6	0.322	18.3	0.324	24.3	0.326	31.9	0.328	39.4
0.330	46.5	0.332	52.6	0.334	57.3	0.336	60.8	0.338	64.8
0.340	67.7	0.342	70.5	0.344	72.2	0.346	74.4	0.348	75.9
0.350	77.2	0.352	78.5	0.354	80.0	0.356	81.1	0.358	83.1
0.360	84.1	0.362	85.9	0.370	86.9	0.375	88.2	0.380	89.5
0.385	91.0	0.390	91.8	0.395	92.1	0.400	92.6	0.405	92.6
0.410	93.2	0.415	93.4	0.420	93.7	0.425	93.5	0.430	93.9
0.435	93.9	0.440	94.2	0.445	93.7	0.450	93.8	0.455	94.0
0.460	94.2	0.465	93.9	0.470	93.8	0.475	93.4	0.480	94.1
0.495	93.7	0.497	93.9	0.495	93.8	0.500	94.1	0.505	94.3
0.510	93.9	0.515	94.3	0.520	93.8	0.525	94.3	0.530	94.5
0.535	94.6	0.540	94.5	0.545	94.4	0.550	94.4	0.555	94.8
0.560	94.5	0.565	94.8	0.570	94.8	0.575	94.6	0.580	94.8
0.585	94.8	0.590	94.7	0.595	94.5	0.600	94.6	0.605	94.5
0.610	94.5	0.615	94.6	0.620	94.6	0.625	94.7	0.630	94.6
0.635	94.6	0.640	94.7	0.645	94.9	0.650	94.7	0.655	94.5
0.660	94.8	0.665	94.7	0.670	94.9	0.675	94.8	0.680	94.9
0.685	94.6	0.690	94.8	0.695	94.7	0.700	94.9	0.720	95.0
0.740	95.0	0.760	94.9	0.780	94.9	0.800	94.8	0.820	94.9
0.840	94.8	0.860	95.0	0.880	95.0	0.900	95.2	0.920	95.1
0.940	94.8	0.960	95.2	0.980	95.2	1.000	94.9	1.020	95.0
1.040	94.8	1.060	95.2	1.080	95.0	1.100	95.2	1.120	95.0
1.140	95.0	1.160	95.1	1.180	94.9	1.200	95.2	1.220	95.2
1.240	95.1	1.260	95.3	1.280	95.2	1.300	95.2	1.320	95.1
1.340	94.7	1.360	94.1	1.380	93.9	1.400	94.6	1.420	94.8
1.440	94.9	1.460	94.9	1.480	95.0	1.500	95.1	1.520	94.9
1.540	94.8	1.560	94.3	1.580	94.9	1.600	94.7	1.620	94.8
1.640	94.6	1.660	92.7	1.680	94.6	1.700	94.3	1.720	94.0
1.740	94.2	1.760	94.1	1.780	93.6	1.800	93.6	1.820	93.4
1.840	93.4	1.860	93.5	1.880	92.3	1.900	93.2	1.920	92.8
1.940	92.9	1.960	92.6	1.980	92.3	2.000	92.1	2.020	91.4
2.040	90.7	2.060	90.0	2.080	89.1	2.100	88.4	2.120	84.9
2.140	87.2	2.160	86.6	2.180	85.9	2.200	85.4	2.220	84.9
2.240	85.0	2.260	84.4	2.280	83.4	2.300	82.7	2.320	81.2
2.340	84.8	2.360	84.2	2.380	83.4	2.400	82.7	2.420	81.2
2.440	80.4	2.460	80.2	2.480	79.3	2.500	78.3		

FIGURE . EFFECT OF REAL-TIME SOLAR UV, VACUUM UV, PROTONS

AND ELECTRONS ON THE REFLECTANCE OF AK-7 CROWN GLASS IN SITU
IN SITU, AFTER 50 HOURS EXPOSURE

IN 31TU, AFTER 50 HOURS EXPOSURE

 $\text{ALPHA}(9) = 0.106$

WAVELENGTH (λ MUMBA)	F (λ MUMBA)	WAVELENGTH (λ MUMBA)	F (λ MUMBA)	WAVELENGTH (λ MUMBA)	F (λ MUMBA)	WAVELENGTH (λ MUMBA)	F (λ MUMBA)
0.232	0.0	0.232	0.0	0.232	0.0	0.232	0.0
0.240	0.0	0.240	0.0	0.240	0.0	0.240	0.0
0.250	5.7	0.252	6.0	0.254	6.1	0.256	6.0
0.260	5.9	0.262	5.9	0.264	5.9	0.266	5.8
0.270	6.0	0.272	5.8	0.274	5.8	0.276	5.9
0.280	5.6	0.282	5.5	0.284	5.5	0.286	5.7
0.290	5.6	0.292	5.5	0.294	5.7	0.296	5.7
0.300	5.9	0.302	5.9	0.304	6.1	0.306	6.2
0.310	6.5	0.312	6.7	0.314	7.4	0.316	8.1
0.320	12.5	0.322	14.7	0.324	22.1	0.326	20.6
0.330	41.0	0.332	47.3	0.334	51.5	0.336	55.1
0.340	61.3	0.342	63.2	0.344	65.7	0.346	67.5
0.350	70.7	0.352	72.5	0.354	73.7	0.356	75.3
0.360	77.9	0.362	79.5	0.364	81.2	0.366	82.6
0.370	86.1	0.372	86.6	0.374	87.5	0.376	88.2
0.380	89.8	0.382	89.5	0.384	89.8	0.386	90.0
0.390	90.5	0.392	90.8	0.394	90.6	0.396	91.0
0.400	91.0	0.402	91.4	0.404	90.9	0.406	91.1
0.410	91.4	0.412	91.3	0.414	92.1	0.416	91.8
0.420	92.0	0.422	92.2	0.424	92.1	0.426	92.2
0.430	92.5	0.432	92.9	0.434	93.0	0.436	92.5
0.440	93.1	0.442	93.7	0.444	93.9	0.446	93.4
0.450	93.8	0.452	93.8	0.454	93.5	0.456	94.0
0.460	93.4	0.462	93.4	0.464	93.5	0.466	93.6
0.470	93.5	0.472	93.7	0.474	93.8	0.476	93.6
0.480	94.0	0.482	94.0	0.484	93.8	0.486	93.9
0.490	94.2	0.492	94.2	0.494	94.3	0.496	94.1
0.500	94.7	0.502	94.6	0.504	95.1	0.506	94.9
0.510	95.0	0.512	95.2	0.514	95.0	0.516	95.2
0.520	95.1	0.522	95.3	0.524	95.1	0.526	95.2
0.530	95.4	0.532	95.3	0.534	95.2	0.536	95.3
0.540	94.8	0.542	94.3	0.544	93.9	0.546	94.7
0.550	94.7	0.552	94.9	0.554	95.0	0.556	94.7
0.560	94.9	0.562	95.0	0.564	95.2	0.566	95.3
0.570	95.0	0.572	95.1	0.574	95.1	0.576	95.2
0.580	95.1	0.582	95.3	0.584	95.2	0.586	95.3
0.590	95.4	0.592	95.3	0.594	95.2	0.596	95.3
0.600	94.8	0.602	94.3	0.604	93.9	0.606	94.7
0.610	94.7	0.612	94.9	0.614	95.0	0.616	94.7
0.620	95.0	0.622	95.1	0.624	95.2	0.626	95.3
0.630	95.1	0.632	95.3	0.634	95.2	0.636	95.3
0.640	95.4	0.642	95.3	0.644	95.2	0.646	95.3
0.650	94.8	0.652	94.3	0.654	93.9	0.656	94.7
0.660	94.7	0.662	94.9	0.664	95.0	0.666	94.7
0.670	95.0	0.672	95.1	0.674	95.2	0.676	95.3
0.680	95.1	0.682	95.3	0.684	95.2	0.686	95.3
0.690	95.4	0.692	95.3	0.694	95.2	0.696	95.3
0.700	94.8	0.702	94.3	0.704	93.9	0.706	94.7
0.710	94.7	0.712	94.9	0.714	95.0	0.716	94.7
0.720	95.0	0.722	95.1	0.724	95.2	0.726	95.3
0.730	95.1	0.732	95.3	0.734	95.2	0.736	95.3
0.740	95.4	0.742	95.3	0.744	95.2	0.746	95.3
0.750	94.8	0.752	94.3	0.754	93.9	0.756	94.7
0.760	94.7	0.762	94.9	0.764	95.0	0.766	94.7
0.770	95.0	0.772	95.1	0.774	95.2	0.776	95.3
0.780	95.1	0.782	95.3	0.784	95.2	0.786	95.3
0.790	95.4	0.792	95.3	0.794	95.2	0.796	95.3
0.800	94.8	0.802	94.3	0.804	93.9	0.806	94.7
0.810	94.7	0.812	94.9	0.814	95.0	0.816	94.7
0.820	95.0	0.822	95.1	0.824	95.2	0.826	95.3
0.830	95.1	0.832	95.3	0.834	95.2	0.836	95.3
0.840	95.4	0.842	95.3	0.844	95.2	0.846	95.3
0.850	94.8	0.852	94.3	0.854	93.9	0.856	94.7
0.860	94.7	0.862	94.9	0.864	95.0	0.866	94.7
0.870	95.0	0.872	95.1	0.874	95.2	0.876	95.3
0.880	95.1	0.882	95.3	0.884	95.2	0.886	95.3
0.890	95.4	0.892	95.3	0.894	95.2	0.896	95.3
0.900	94.8	0.902	94.3	0.904	93.9	0.906	94.7
0.910	94.7	0.912	94.9	0.914	95.0	0.916	94.7
0.920	95.0	0.922	95.1	0.924	95.2	0.926	95.3
0.930	95.1	0.932	95.3	0.934	95.2	0.936	95.3
0.940	95.4	0.942	95.3	0.944	95.2	0.946	95.3
0.950	94.8	0.952	94.3	0.954	93.9	0.956	94.7
0.960	94.7	0.962	94.9	0.964	95.0	0.966	94.7
0.970	95.0	0.972	95.1	0.974	95.2	0.976	95.3
0.980	95.1	0.982	95.3	0.984	95.2	0.986	95.3
0.990	95.4	0.992	95.3	0.994	95.2	0.996	95.3
1.000	94.8	1.002	94.3	1.004	93.9	1.006	94.7
1.010	94.7	1.012	94.9	1.014	95.0	1.016	94.7
1.020	95.0	1.022	95.1	1.024	95.2	1.026	95.3
1.030	95.1	1.032	95.3	1.034	95.2	1.036	95.3
1.040	95.4	1.042	95.3	1.044	95.2	1.046	95.3
1.050	94.8	1.052	94.3	1.054	93.9	1.056	94.7
1.060	94.7	1.062	94.9	1.064	95.0	1.066	94.7
1.070	95.0	1.072	95.1	1.074	95.2	1.076	95.3
1.080	95.1	1.082	95.3	1.084	95.2	1.086	95.3
1.090	95.4	1.092	95.3	1.094	95.2	1.096	95.3
1.100	94.8	1.102	94.3	1.104	93.9	1.106	94.7
1.110	94.7	1.112	94.9	1.114	95.0	1.116	94.7
1.120	95.0	1.122	95.1	1.124	95.2	1.126	95.3
1.130	95.1	1.132	95.3	1.134	95.2	1.136	95.3
1.140	95.4	1.142	95.3	1.144	95.2	1.146	95.3
1.150	94.8	1.152	94.3	1.154	93.9	1.156	94.7
1.160	94.7	1.162	94.9	1.164	95.0	1.166	94.7
1.170	95.0	1.172	95.1	1.174	95.2	1.176	95.3
1.180	95.1	1.182	95.3	1.184	95.2	1.186	95.3
1.190	95.4	1.192	95.3	1.194	95.2	1.196	95.3
1.200	94.8	1.202	94.3	1.204	93.9	1.206	94.7
1.210	94.7	1.212	94.9	1.214	95.0	1.216	94.7
1.220	95.0	1.222	95.1	1.224	95.2	1.226	95.3
1.230	95.1	1.232	95.3	1.234	95.2	1.236	95.3
1.240	95.4	1.242	95.3	1.244	95.2	1.246	95.3
1.250	94.8	1.252	94.3	1.254	93.9	1.256	94.7
1.260	94.7	1.262	94.9	1.264	95.0	1.266	94.7
1.270	95.0	1.272	95.1	1.274	95.2	1.276	95.3
1.280	95.1	1.282	95.3	1.284	95.2	1.286	95.3
1.290	95.4	1.292	95.3	1.294	95.2	1.296	95.3
1.300	94.8	1.302	94.3	1.304	93.9	1.306	94.7
1.310	94.7	1.312	94.9	1.314	95.0	1.316	94.7
1.320	95.0	1.322	95.1	1.324	95.2	1.326	95.3
1.330	95.1	1.332	95.3	1.334	95.2	1.336	95.3
1.340	95.4	1.342	95.3	1.344	95.2	1.346	95.3
1.350	94.8	1.352	94.3	1.354	93.9	1.356	94.7
1.360	94.7	1.362	94.9	1.364	95.0	1.366	94.7
1.370	95.0	1.372	95.1	1.374	95.2	1.376	95.3
1.380	95.1	1.382	95.3	1.384	95.2	1.386	95.3
1.390	95.4	1.392	95.3	1.394	95.2	1.396	95.3
1.400	94.8	1.402	94.3	1.404	93.9	1.406	94.7
1.410	94.7	1.412	94.9	1.414	95.0	1.416	94.7
1.420	95.0	1.422	95.1	1.424	95.2	1.426	95.3
1.430	95.1	1.432	95.3	1.434	95.2	1.436	95.3
1.440	95.4	1.442	95.3	1.444	95.2	1.446	95.3
1.450	94.8	1.452	94.3	1.454	93.9	1.456	94.7
1.460	94.7	1.462	94.9	1.464	95.0	1.466	94.7
1.470	95.0	1.472	95.1	1.474	95.2	1.476	95.3
1.480	95.1	1.482	95.3	1.484	95.2	1.486	95.3
1.490	95.4	1.492	95.3	1.494	95.2	1.496	95.3
1.500	94.8	1.502	94.3	1.504	93.9	1.506	94.7
1.510	94.7	1.512	94.9	1.514	95.0	1.516	94.7
1.520	95.0	1.522	95.1	1.524	95.2	1.526	95.3
1.530	95.1	1.532	95.3	1.534	95.2	1.536	95.3
1.540	95.4	1.542	95.3	1.544	95.2	1.546	95.3
1.550	94.8	1.552	94.3	1.554	93.9	1.556	94.7
1.560	94.7	1.562	94.9	1.564	95.0	1.566	94.7
1.570	95.0	1.572	95.1	1.574	95.2	1.576	95.3
1.580	95.1	1.582	95.3	1.584	95.2	1.586	95.3
1.590	95.4	1.592	95.3	1.594	95.2	1.596	95.3
1.600	94.8	1.602	94.3	1.604	93.9	1.606	94.7
1.610	94.7	1.612	94.9	1.614	95.0	1.616	94.7
1.620	95.0	1.622	95.1	1.624	95.2	1.626	95.3
1.630	95.1	1.632	95.3	1.634	95.2	1.636	95.3
1.640	95.4	1.642	95.3	1.644	95.2	1.646	95.3
1.650	94.8	1.652	94.3	1.654	93.9	1.656	94.7
1.660	94.7	1.662	94.9	1.664	95.0	1.666	94.7
1.670	95.0	1.672	95.1	1.674	95.2	1.676	95.3
1.680	95.1	1.682	95.3	1.684	95.2	1.686	95.3
1.690	95.4	1.692	95.3	1.694	95.2	1.696	95.3
1.700	94.8	1.702	94.3	1.704	93.9	1.706	94.7
1.710	94.7	1.712	94.9	1.714	95.0	1.716	94.7
1.720	95.0	1.722	95.1	1.724	95.2	1.726	95.3
1.730	95.1	1.732	95.3	1.734	95.2	1.736	95.3
1.740	95.4	1.742	95.3	1.744	95.2	1.746	95.3
1.750	94.8	1.752	94.3	1.754	93.9	1.756	94.7
1.760	94.7	1.762					

FIGURE 1. EFFECT OF REAL-TIME SOLAR UV, VACUUM UV, PROTONS,

AND ELECTRONS ON THE REFLECTANCE OF BK-7 CROWN GLASS IN SITU
IN SITU, AFTER 150 HOURS EXPOSURE

$$\text{ALPHA}(S) = 0.109$$

HEMISPHERICAL SPECTRAL REFLECTANCE				VS. WAVELENGTH				ALPHA(S) = 0.10			
WAVELENGTH (LAMDA)	F(LAMDA)	WAVELENGTH (LAMDA)	F(LAMDA)	WAVELENGTH (LAMDA)	F(LAMDA)	WAVELENGTH (LAMDA)	F(LAMDA)	WAVELENGTH (LAMDA)	F(LAMDA)	WAVELENGTH (LAMDA)	F(LAMDA)
0.230	0.0	0.232	0.0	0.234	0.0	0.236	0.0	0.238	0.0	0.240	0.0
0.240	0.0	0.242	0.0	0.244	0.0	0.246	0.0	0.248	0.0	0.250	0.0
0.250	6.4	0.252	6.4	0.254	6.4	0.256	6.5	0.258	6.5	0.260	6.4
0.260	6.4	0.262	6.4	0.264	6.4	0.266	6.5	0.268	6.5	0.270	6.4
0.270	6.3	0.272	6.3	0.274	6.2	0.276	6.3	0.278	6.3	0.280	6.2
0.280	6.3	0.282	6.3	0.284	6.2	0.286	6.2	0.288	6.2	0.290	6.5
0.290	6.1	0.292	6.2	0.294	6.3	0.296	6.3	0.298	6.5	0.300	6.8
0.300	6.6	0.302	6.6	0.304	6.6	0.306	6.7	0.308	6.7	0.310	6.8
0.310	7.1	0.312	7.5	0.314	7.9	0.316	8.7	0.318	10.6	0.320	10.6
0.320	13.1	0.322	17.1	0.324	22.0	0.326	28.6	0.328	34.8	0.330	34.8
0.330	40.5	0.332	45.7	0.334	49.5	0.336	53.2	0.338	56.8	0.340	56.8
0.340	59.1	0.342	61.3	0.344	63.1	0.346	64.7	0.348	66.7	0.350	66.7
0.350	68.3	0.352	69.5	0.354	71.0	0.356	72.2	0.358	73.8	0.360	73.8
0.360	74.4	0.362	77.0	0.364	78.8	0.366	80.7	0.368	82.4	0.370	82.4
0.370	83.4	0.372	84.9	0.374	86.4	0.376	87.7	0.378	89.1	0.380	89.1
0.380	87.6	0.382	88.0	0.384	88.4	0.386	88.3	0.388	89.1	0.390	89.1
0.390	88.4	0.392	89.2	0.394	89.2	0.396	89.7	0.398	90.1	0.400	90.1
0.400	90.1	0.402	90.1	0.404	90.4	0.406	90.2	0.408	90.7	0.410	90.7
0.410	90.5	0.412	90.7	0.414	91.1	0.416	91.2	0.418	91.6	0.420	91.6
0.420	91.2	0.422	91.6	0.424	91.5	0.426	91.2	0.428	92.5	0.430	92.5
0.430	92.0	0.432	92.5	0.434	92.6	0.436	92.5	0.438	92.9	0.440	92.9
0.440	92.9	0.442	93.5	0.444	93.3	0.446	93.2	0.448	93.4	0.450	93.4
0.450	93.8	0.452	93.6	0.454	93.1	0.456	93.7	0.458	93.0	0.460	93.0
0.460	93.7	0.462	93.3	0.464	93.5	0.466	93.7	0.468	93.6	0.470	93.6
0.470	93.6	0.472	94.0	0.474	94.2	0.476	94.3	0.478	94.0	0.480	94.0
0.480	94.1	0.482	94.1	0.484	94.9	0.486	94.8	0.488	94.5	0.490	94.5
0.490	94.7	0.492	94.8	0.494	95.2	0.496	95.2	0.498	95.2	0.500	95.2
0.500	94.9	0.502	95.3	0.504	95.2	0.506	95.0	0.508	95.3	0.510	95.3
0.510	95.0	0.512	95.2	0.514	95.2	0.516	95.4	0.518	95.2	0.520	95.2
0.520	95.0	0.522	95.3	0.524	95.2	0.526	95.4	0.528	95.2	0.530	95.2
0.530	95.3	0.532	95.5	0.534	95.4	0.536	95.4	0.538	95.2	0.540	95.2
0.540	94.7	0.542	94.3	0.544	94.1	0.546	94.7	0.548	94.9	0.550	94.9
0.550	94.9	0.552	95.0	0.554	94.9	0.556	95.1	0.558	95.0	0.560	95.0

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OF POOR QUALITY

FIGURE 1. EFFECT OF RELATIVE SOLAR UV, VACUUM UV, PHOTOONS, AND ELECTRONS ON THE REFLECTANCE OF HAPY CROWN GLASS IN SITU IN SITU, AFTER 513 HOURS EXPOSURE

HEMISPHERICAL SPECTRAL REFLECTANCE			VS. WAVELENGTH			ALPHA(0) = 0.110			
WAVELENGTH (λ nm)	F(λ nm)	WAVELENGTH (λ nm)	F(λ nm)	WAVELENGTH (λ nm)	F(λ nm)	WAVELENGTH (λ nm)	F(λ nm)	WAVELENGTH (λ nm)	F(λ nm)
0.230	0.0	0.232	0.0	0.234	0.0	0.236	0.0	0.238	0.0
0.240	0.0	0.242	0.0	0.244	0.0	0.246	0.0	0.248	0.0
0.250	0.0	0.252	0.0	0.254	0.0	0.256	0.0	0.258	0.0
0.260	0.0	0.262	0.0	0.264	0.0	0.266	0.0	0.268	0.0
0.270	0.0	0.272	0.0	0.274	0.0	0.276	0.0	0.278	0.0
0.280	0.0	0.282	0.0	0.284	0.0	0.286	0.0	0.288	0.0
0.290	0.0	0.292	0.0	0.294	0.0	0.296	0.0	0.298	0.0
0.300	0.0	0.302	0.0	0.304	0.0	0.306	0.0	0.308	0.0
0.310	0.0	0.312	0.0	0.314	0.0	0.316	0.0	0.318	0.0
0.320	0.0	0.322	0.0	0.324	0.0	0.326	0.0	0.328	0.0
0.330	0.0	0.332	0.0	0.334	0.0	0.336	0.0	0.338	0.0
0.340	0.0	0.342	0.0	0.344	0.0	0.346	0.0	0.348	0.0
0.350	0.0	0.352	0.0	0.354	0.0	0.356	0.0	0.358	0.0
0.360	0.0	0.362	0.0	0.364	0.0	0.366	0.0	0.368	0.0
0.370	0.0	0.372	0.0	0.374	0.0	0.376	0.0	0.378	0.0
0.380	0.0	0.382	0.0	0.384	0.0	0.386	0.0	0.388	0.0
0.390	0.0	0.392	0.0	0.394	0.0	0.396	0.0	0.398	0.0
0.400	0.0	0.402	0.0	0.404	0.0	0.406	0.0	0.408	0.0
0.410	0.0	0.412	0.0	0.414	0.0	0.416	0.0	0.418	0.0
0.420	0.0	0.422	0.0	0.424	0.0	0.426	0.0	0.428	0.0
0.430	0.0	0.432	0.0	0.434	0.0	0.436	0.0	0.438	0.0
0.440	0.0	0.442	0.0	0.444	0.0	0.446	0.0	0.448	0.0
0.450	0.0	0.452	0.0	0.454	0.0	0.456	0.0	0.458	0.0
0.460	0.0	0.462	0.0	0.464	0.0	0.466	0.0	0.468	0.0
0.470	0.0	0.472	0.0	0.474	0.0	0.476	0.0	0.478	0.0
0.480	0.0	0.482	0.0	0.484	0.0	0.486	0.0	0.488	0.0
0.490	0.0	0.492	0.0	0.494	0.0	0.496	0.0	0.498	0.0
0.500	0.0	0.502	0.0	0.504	0.0	0.506	0.0	0.508	0.0
0.510	0.0	0.512	0.0	0.514	0.0	0.516	0.0	0.518	0.0
0.520	0.0	0.522	0.0	0.524	0.0	0.526	0.0	0.528	0.0
0.530	0.0	0.532	0.0	0.534	0.0	0.536	0.0	0.538	0.0
0.540	0.0	0.542	0.0	0.544	0.0	0.546	0.0	0.548	0.0
0.550	0.0	0.552	0.0	0.554	0.0	0.556	0.0	0.558	0.0
0.560	0.0	0.562	0.0	0.564	0.0	0.566	0.0	0.568	0.0
0.570	0.0	0.572	0.0	0.574	0.0	0.576	0.0	0.578	0.0
0.580	0.0	0.582	0.0	0.584	0.0	0.586	0.0	0.588	0.0
0.590	0.0	0.592	0.0	0.594	0.0	0.596	0.0	0.598	0.0
0.600	0.0	0.602	0.0	0.604	0.0	0.606	0.0	0.608	0.0
0.610	0.0	0.612	0.0	0.614	0.0	0.616	0.0	0.618	0.0
0.620	0.0	0.622	0.0	0.624	0.0	0.626	0.0	0.628	0.0
0.630	0.0	0.632	0.0	0					

FIGURE . EFFECT OF REAL-TIME SOLAR UV, VACUUM UV, PROTONS, K-3
AND ELECTRONS ON THE REFLECTANCE OF BK-7 CROWN GLASS IN SITU IN SITU, AFTER 503 HOURS EXPOSURE 23 AUG 76

HEMISPHERICAL SPECTRAL REFLECTANCE VS. WAVELENGTH

VS. WAVELENGTH

HEMISPHERICAL SPECTRAL REFLECTANCE

ALPHA(S) = 0.118

WAVELENGTH (λ Å)	F(λ Å)	WAVELENGTH (λ Å)	F(λ Å)	WAVELENGTH (λ Å)	F(λ Å)	WAVELENGTH (λ Å)	F(λ Å)	WAVELENGTH (λ Å)	F(λ Å)	WAVELENGTH (λ Å)	F(λ Å)
0.230	0.0	0.232	0.0	0.234	0.0	0.236	0.0	0.238	0.0	0.240	0.0
0.240	0.0	0.242	0.0	0.244	0.0	0.246	0.0	0.248	0.0	0.250	0.0
0.250	6.9	0.252	6.9	0.254	7.0	0.256	7.0	0.258	6.9	0.260	6.8
0.260	6.8	0.262	6.9	0.264	6.8	0.266	6.7	0.268	6.7	0.270	6.6
0.270	6.7	0.272	6.7	0.274	6.7	0.276	6.6	0.278	6.6	0.280	6.6
0.280	6.7	0.282	6.5	0.284	6.6	0.286	6.6	0.288	6.7	0.290	6.7
0.290	6.4	0.292	6.5	0.294	6.5	0.296	6.6	0.298	6.6	0.300	7.1
0.300	6.9	0.302	6.8	0.304	7.1	0.306	6.9	0.308	6.9	0.310	7.1
0.310	7.2	0.312	7.6	0.314	8.0	0.316	8.9	0.318	10.4	0.320	10.4
0.320	12.7	0.322	16.3	0.324	21.0	0.326	27.0	0.328	32.5	0.330	32.5
0.330	37.8	0.332	42.6	0.334	46.0	0.336	49.2	0.338	52.0	0.340	52.0
0.340	54.4	0.342	56.7	0.344	59.0	0.346	60.0	0.348	61.9	0.350	61.9
0.350	63.5	0.352	65.1	0.354	66.1	0.356	67.3	0.358	68.3	0.360	68.3
0.360	70.2	0.362	72.4	0.364	74.5	0.366	75.9	0.368	78.1	0.370	78.1
0.370	79.7	0.372	81.0	0.374	82.1	0.376	82.8	0.378	83.6	0.380	83.6
0.380	84.4	0.382	84.6	0.384	85.2	0.386	85.3	0.388	86.2	0.390	86.2
0.390	86.1	0.392	86.6	0.394	86.8	0.396	87.5	0.398	87.5	0.400	87.5
0.400	87.7	0.402	88.0	0.404	88.0	0.406	88.8	0.408	88.8	0.410	88.8
0.410	88.5	0.412	88.5	0.414	89.1	0.416	89.7	0.418	89.7	0.420	89.7
0.420	89.8	0.422	89.8	0.424	89.9	0.426	90.5	0.428	90.5	0.430	90.5
0.430	90.4	0.432	91.4	0.434	91.6	0.436	91.5	0.438	91.5	0.440	91.5
0.440	91.8	0.442	92.2	0.444	92.2	0.446	92.6	0.448	92.6	0.450	92.6
0.450	93.1	0.452	93.4	0.454	93.4	0.456	93.1	0.458	92.7	0.460	92.7
0.460	93.0	0.462	92.7	0.464	92.9	0.466	93.0	0.468	93.0	0.470	93.0
0.470	93.5	0.472	93.3	0.474	93.2	0.476	93.3	0.478	93.6	0.480	93.6
0.480	93.7	0.482	93.3	0.484	93.2	0.486	94.2	0.488	94.2	0.490	94.2
0.490	94.4	0.492	93.7	0.494	93.8	0.496	93.9	0.498	94.2	0.500	94.2
0.500	94.7	0.502	94.5	0.504	94.7	0.506	94.6	0.508	94.7	0.510	94.7
0.510	94.7	0.512	95.0	0.514	95.0	0.516	95.2	0.518	94.9	0.520	94.9
0.520	95.0	0.522	95.3	0.524	95.2	0.526	95.2	0.528	95.2	0.530	95.2
0.530	95.1	0.532	95.2	0.534	95.1	0.536	95.3	0.538	95.2	0.540	95.2
0.540	95.4	0.542	95.4	0.544	95.3	0.546	95.3	0.548	95.0	0.550	95.0
0.550	94.7	0.552	94.1	0.554	94.0	0.556	94.5	0.558	94.8	0.560	94.8

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K=2

FIGURE . EFFECT OF REAL-TIME SOLAR UV, VACUUM UV, PROTONS, IN VACUUM, BEFORE EXPOSURE
AND ELECTRONS ON THE REFLECTANCE OF BK-7 CHOWN GLASS IN SITU

HEMISPHERICAL SPECTRAL REFLECTANCE VS. WAVELENGTH				ALPHA(S) = 0.098			
WAVELENGTH (LAMRDA)	F(LAMRDA)	WAVELENGTH (LAMRDA)	F(LAMRDA)	WAVELENGTH (LAMRDA)	F(LAMRDA)	WAVELENGTH (LAMRDA)	F(LAMRDA)
0.230	0.0	0.232	0.0	0.236	0.0	0.238	0.0
0.240	0.0	0.242	0.0	0.244	0.0	0.246	0.0
0.250	6.1	0.252	6.8	0.254	6.0	0.256	6.2
0.260	6.7	0.262	6.2	0.264	6.5	0.266	6.1
0.270	6.3	0.272	5.9	0.274	6.3	0.276	6.2
0.280	5.9	0.282	5.7	0.284	6.1	0.286	6.1
0.290	6.1	0.292	6.4	0.294	6.5	0.296	6.8
0.300	6.5	0.302	6.6	0.304	6.6	0.306	7.7
0.310	6.8	0.312	7.4	0.314	8.1	0.316	9.1
0.320	14.1	0.322	18.8	0.324	24.4	0.326	31.9
0.330	40.3	0.332	52.0	0.334	56.4	0.336	60.1
0.340	66.7	0.342	69.3	0.344	71.4	0.346	75.0
0.350	76.6	0.352	77.7	0.354	78.9	0.356	81.8
0.360	82.3	0.362	84.3	0.364	85.5	0.366	88.0
0.370	89.5	0.372	90.4	0.374	90.9	0.376	91.5
0.380	92.1	0.382	92.3	0.384	92.6	0.386	92.9
0.390	93.3	0.392	93.0	0.394	93.0	0.396	93.2
0.400	93.1	0.402	93.2	0.404	93.3	0.406	93.6
0.410	93.7	0.412	93.9	0.414	93.9	0.416	94.1
0.420	94.0	0.422	94.3	0.424	94.3	0.426	94.1
0.430	94.4	0.432	94.2	0.434	93.8	0.436	93.9
0.440	93.9	0.442	94.0	0.444	94.4	0.446	94.0
0.450	94.2	0.452	94.3	0.454	94.4	0.456	94.4
0.460	94.0	0.462	94.0	0.464	94.4	0.466	94.4
0.470	94.2	0.472	94.3	0.474	94.4	0.476	94.4
0.480	94.3	0.482	94.3	0.484	94.4	0.486	94.4
0.490	94.3	0.492	94.3	0.494	94.4	0.496	94.4
0.500	94.3	0.502	94.3	0.504	94.4	0.506	94.4
0.510	94.3	0.512	94.3	0.514	94.4	0.516	94.4
0.520	94.3	0.522	94.3	0.524	94.4	0.526	94.4
0.530	94.3	0.532	94.3	0.534	94.4	0.536	94.4
0.540	94.3	0.542	94.3	0.544	94.4	0.546	94.4
0.550	94.3	0.552	94.3	0.554	94.4	0.556	94.4
0.560	94.3	0.562	94.3	0.564	94.4	0.566	94.4
0.570	94.3	0.572	94.3	0.574	94.4	0.576	94.4
0.580	94.3	0.582	94.3	0.584	94.4	0.586	94.4
0.590	94.3	0.592	94.3	0.594	94.4	0.596	94.4
0.600	94.3	0.602	94.3	0.604	94.4	0.606	94.4
0.610	94.3	0.612	94.3	0.614	94.4	0.616	94.4
0.620	94.3	0.622	94.3	0.624	94.4	0.626	94.4
0.630	94.3	0.632	94.3	0.634	94.4	0.636	94.4
0.640	94.3	0.642	94.3	0.644	94.4	0.646	94.4
0.650	94.3	0.652	94.3	0.654	94.4	0.656	94.4
0.660	94.3	0.662	94.3	0.664	94.4	0.666	94.4
0.670	94.3	0.672	94.3	0.674	94.4	0.676	94.4
0.680	94.3	0.682	94.3	0.684	94.4	0.686	94.4
0.690	94.3	0.692	94.3	0.694	94.4	0.696	94.4
0.700	94.3	0.702	94.3	0.704	94.4	0.706	94.4
0.710	94.3	0.712	94.3	0.714	94.4	0.716	94.4
0.720	94.3	0.722	94.3	0.724	94.4	0.726	94.4
0.730	94.3	0.732	94.3	0.734	94.4	0.736	94.4
0.740	94.3	0.742	94.3	0.744	94.4	0.746	94.4
0.750	94.3	0.752	94.3	0.754	94.4	0.756	94.4
0.760	94.3	0.762	94.3	0.764	94.4	0.766	94.4
0.770	94.3	0.772	94.3	0.774	94.4	0.776	94.4
0.780	94.3	0.782	94.3	0.784	94.4	0.786	94.4
0.790	94.3	0.792	94.3	0.794	94.4	0.796	94.4
0.800	94.3	0.802	94.3	0.804	94.4	0.806	94.4
0.810	94.3	0.812	94.3	0.814	94.4	0.816	94.4
0.820	94.3	0.822	94.3	0.824	94.4	0.826	94.4
0.830	94.3	0.832	94.3	0.834	94.4	0.836	94.4
0.840	94.3	0.842	94.3	0.844	94.4	0.846	94.4
0.850	94.3	0.852	94.3	0.854	94.4	0.856	94.4
0.860	94.3	0.862	94.3	0.864	94.4	0.866	94.4
0.870	94.3	0.872	94.3	0.874	94.4	0.876	94.4
0.880	94.3	0.882	94.3	0.884	94.4	0.886	94.4
0.890	94.3	0.892	94.3	0.894	94.4	0.896	94.4
0.900	94.3	0.902	94.3	0.904	94.4	0.906	94.4
0.910	94.3	0.912	94.3	0.914	94.4	0.916	94.4
0.920	94.3	0.922	94.3	0.924	94.4	0.926	94.4
0.930	94.3	0.932	94.3	0.934	94.4	0.936	94.4
0.940	94.3	0.942	94.3	0.944	94.4	0.946	94.4
0.950	94.3	0.952	94.3	0.954	94.4	0.956	94.4
0.960	94.3	0.962	94.3	0.964	94.4	0.966	94.4
0.970	94.3	0.972	94.3	0.974	94.4	0.976	94.4
0.980	94.3	0.982	94.3	0.984	94.4	0.986	94.4
0.990	94.3	0.992	94.3	0.994	94.4	0.996	94.4
1.000	94.3	1.002	94.3	1.004	94.4	1.006	94.4
1.010	94.3	1.012	94.3	1.014	94.4	1.016	94.4
1.020	94.3	1.022	94.3	1.024	94.4	1.026	94.4
1.030	94.3	1.032	94.3	1.034	94.4	1.036	94.4
1.040	94.3	1.042	94.3	1.044	94.4	1.046	94.4
1.050	94.3	1.052	94.3	1.054	94.4	1.056	94.4
1.060	94.3	1.062	94.3	1.064	94.4	1.066	94.4
1.070	94.3	1.072	94.3	1.074	94.4	1.076	94.4
1.080	94.3	1.082	94.3	1.084	94.4	1.086	94.4
1.090	94.3	1.092	94.3	1.094	94.4	1.096	94.4
1.100	94.3	1.102	94.3	1.104	94.4	1.106	94.4
1.110	94.3	1.112	94.3	1.114	94.4	1.116	94.4
1.120	94.3	1.122	94.3	1.124	94.4	1.126	94.4
1.130	94.3	1.132	94.3	1.134	94.4	1.136	94.4
1.140	94.3	1.142	94.3	1.144	94.4	1.146	94.4
1.150	94.3	1.152	94.3	1.154	94.4	1.156	94.4
1.160	94.3	1.162	94.3	1.164	94.4	1.166	94.4
1.170	94.3	1.172	94.3	1.174	94.4	1.176	94.4
1.180	94.3	1.182	94.3	1.184	94.4	1.186	94.4
1.190	94.3	1.192	94.3	1.194	94.4	1.196	94.4
1.200	94.3	1.202	94.3	1.204	94.4	1.206	94.4
1.210	94.3	1.212	94.3	1.214	94.4	1.216	94.4
1.220	94.3	1.222	94.3	1.224	94.4	1.226	94.4
1.230	94.3	1.232	94.3	1.234	94.4	1.236	94.4
1.240	94.3	1.242	94.3	1.244	94.4	1.246	94.4
1.250	94.3	1.252	94.3	1.254	94.4	1.256	94.4
1.260	94.3	1.262	94.3	1.264	94.4	1.266	94.4
1.270	94.3	1.272	94.3	1.274	94.4	1.276	94.4
1.280	94.3	1.282	94.3	1.284	94.4	1.286	94.4
1.290	94.3	1.292	94.3	1.294	94.4	1.296	94.4
1.300	94.3	1.302	94.3	1.304	94.4	1.306	94.4
1.310	94.3	1.312	94.3	1.314	94.4	1.316	94.4
1.320	94.3	1.322	94.3	1.324	94.4	1.326	94.4
1.330	94.3	1.332	94.3	1.334	94.4	1.336	94.4
1.340	94.3	1.342	94.3	1.344	94.4	1.346	94.4
1.350	94.3	1.352	94.3	1.354	94.4	1.356	94.4
1.360	94.3	1.362	94.3	1.364	94.4	1.366	94.4
1.370	94.3	1.372	94.3	1.374	94.4	1.376	94.4
1.380	94.3	1.382	94.3	1.384	94.4	1.386	94.4
1.390	94.3	1.392	94.3	1.394	94.4	1.396	94.4
1.400	94.3	1.402	94.3	1.404	94.4	1.406	94.4
1.410	94.3	1.412	94.3	1.414	94.4	1.416	94.4
1.420	94.3	1.422	94.3	1.424	94.4	1.426	94.4
1.430	94.3	1.432	94.3	1.434	94.4	1.436	94.4
1.440	94.3	1.442	94.3	1.444	94.4	1.446	94.4
1.450	94.3	1.452	94.3	1.454	94.4	1.456	94.4
1.460	94.3	1.462	94.3	1.464	94.4	1.466	94.4
1.470	94.3	1.472	94.3	1.474	94.4	1.476	94.4
1.480	94.3	1.482	94.3	1.484	94.4	1.486	94.4
1.490	94.3	1.492	94.3	1.494	94.4	1.496	94.4
1.500	94.3	1.502	94.3	1.504	94.4	1.506	94.4
1.510	94.3	1.512	94.3	1.514	94.4	1.516	94.4
1.520	94.3	1.522	94.3	1.524	94.4	1.526	94.4
1.530	94.3	1.532	94.3	1.534	94.4	1.536	94.4
1.540	94.3	1.542	94.3	1.544	94.4	1.546	94.4
1.550	94.3	1.552	94.3	1.554	94.4	1.556	94.4
1.560	94.3	1.562	94.3	1.564	94.4	1.566	94.4
1.570	94.3	1.572	94.3	1.574	94.4	1.576	94.4
1.580	94.3	1.582	94.3	1.584	94.4	1.586	94.4
1.590	94.3	1.592	94.3	1.594	94.4	1.596	94.4
1.600	94.3	1.602	94.3	1.604	94.4	1.606	94.4
1.610	94.3	1.612	94.3	1.614	94.4	1.616	94.4
1.620	94.3	1.622	94.3	1.624	94.4	1.626	94.4
1.630	94.3	1.632	94.3	1.634	94.4	1.636	94.4
1.640	94.3	1.642	94.3	1.644	94.4	1.646	94.4
1.650	94.3	1.652	94.3	1.654	94.4	1.656	94.4
1.660	94.3	1.662	94.3	1.664	94.4	1.666	94.4
1.670	94.3	1.672	94.3	1.674	94.4	1.676	94.4
1.680	94.3	1.682	94.3	1.684	94.4	1.686	94.4
1.690	94.3	1.692	94.3	1.694	94.4	1.696	94.4
1.700	94.3	1.702	94.3	1.704	94.4	1.706	94

x-2

FIGURE 1. EFFECT OF REAL-TIME SOLAR UV, VACUUM UV, PROTONS,

AND ELECTRONS ON THE REFLECTANCE OF BK-7 CROWN GLASS IN SITU .. IN SITU, AFTER 50 HOURS EXPOSURE

 $\text{ALPHA}(9) = 0.109$

VS. WAVELENGTH

WAVELENGTH (λ MBDA)	F(λ MBDA)	WAVELENGTH (λ MBDA)	F(λ MBDA)	WAVELENGTH (λ MBDA)	F(λ MBDA)	WAVELENGTH (λ MBDA)	F(λ MBDA)	WAVELENGTH (λ MBDA)	F(λ MBDA)
0.230	0.0	0.232	0.0	0.234	0.0	0.236	0.0	0.238	0.0
0.240	0.0	0.242	0.0	0.244	0.0	0.246	0.0	0.248	0.0
0.250	6.2	0.252	6.1	0.254	6.1	0.256	6.0	0.258	6.0
0.260	5.9	0.262	5.9	0.264	6.0	0.266	5.9	0.268	6.0
0.270	5.9	0.272	5.8	0.274	5.9	0.276	5.8	0.278	5.7
0.280	5.9	0.282	5.7	0.284	5.7	0.286	5.7	0.288	5.9
0.290	5.9	0.292	5.9	0.294	5.6	0.296	5.8	0.298	5.9
0.300	6.1	0.302	6.0	0.304	6.1	0.306	6.2	0.308	6.4
0.310	6.5	0.312	6.9	0.314	7.5	0.316	8.4	0.318	10.2
0.320	12.7	0.322	18.8	0.324	21.9	0.326	28.7	0.328	35.2
0.330	41.3	0.332	47.1	0.334	51.2	0.336	55.0	0.338	58.0
0.340	70.9	0.342	62.9	0.344	65.3	0.346	66.8	0.348	68.5
0.350	70.2	0.352	71.8	0.354	72.9	0.356	74.3	0.358	75.3
0.360	74.3	0.365	78.3	0.370	79.8	0.375	81.1	0.380	82.9
0.385	84.4	0.390	85.7	0.395	86.1	0.400	86.9	0.405	87.3
0.410	87.9	0.415	88.1	0.420	88.6	0.425	88.9	0.430	89.3
0.435	89.4	0.440	89.6	0.445	89.5	0.450	89.7	0.455	90.0
0.460	89.9	0.465	90.2	0.470	89.7	0.475	89.6	0.480	90.6
0.485	90.4	0.490	90.4	0.495	90.9	0.500	90.8	0.505	91.4
0.510	90.9	0.515	91.3	0.520	91.1	0.525	91.5	0.530	91.6
0.535	91.8	0.540	92.0	0.545	92.0	0.550	92.2	0.555	92.4
0.560	92.3	0.565	92.9	0.570	93.0	0.575	92.6	0.580	92.8
0.585	93.1	0.590	93.0	0.595	92.7	0.600	93.1	0.605	92.7
0.610	93.0	0.615	92.8	0.620	93.1	0.625	92.9	0.630	92.9
0.635	92.9	0.640	93.0	0.645	93.0	0.650	93.4	0.655	93.3
0.660	93.4	0.665	93.5	0.670	93.6	0.675	94.0	0.680	93.8
0.685	94.0	0.690	93.9	0.695	94.0	0.700	94.2	0.720	95.1
0.740	95.1	0.745	95.0	0.780	95.3	0.800	94.9	0.820	94.9
0.840	94.8	0.860	94.8	0.880	95.0	0.900	95.2	0.920	95.2
0.940	95.0	0.960	95.2	0.980	95.1	1.000	95.0	1.020	95.3
1.040	95.1	1.060	95.2	1.080	95.2	1.100	95.4	1.120	95.1
1.140	95.4	1.160	95.1	1.180	95.2	1.200	95.3	1.220	95.4
1.240	95.4	1.260	95.3	1.280	95.2	1.300	95.4	1.320	95.1
1.340	94.8	1.360	94.2	1.380	93.9	1.400	94.6	1.420	94.9
1.440	94.8	1.460	94.9	1.480	95.1	1.500	95.1	1.520	95.0
1.540	94.9	1.560	94.9	1.580	95.0	1.600	94.9	1.620	94.9
1.640	94.4	1.660	94.7	1.680	94.7	1.700	94.4	1.720	94.2
1.740	94.5	1.760	94.2	1.780	93.8	1.800	93.4	1.820	93.7
1.840	93.4	1.860	93.5	1.880	93.3	1.900	93.4	1.920	93.0
1.940	93.0	1.960	92.7	1.980	92.3	2.000	92.2	2.020	91.4
2.040	90.7	2.060	90.3	2.080	89.2	2.100	88.6	2.120	88.3
2.140	87.5	2.160	84.9	2.180	86.1	2.200	85.5	2.220	85.1
2.240	85.3	2.260	85.7	2.280	85.7	2.300	85.6	2.320	85.5
2.340	84.8	2.360	84.4	2.380	83.5	2.400	82.6	2.420	81.7
2.440	80.9	2.460	80.4	2.480	79.5	2.500	79.0		

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K-2

FIGURE . EFFECT OF REAL-TIME SOLAR UV, VACUUM UV, PROTONS,

AND ELECTRONS ON THE REFLECTANCE OF BK-7 CROWN GLASS IN SITU

IN SITU, AFTER 154 HOURS EXPOSURE

ALPHA(9) = 0.111

VS. WAVELENGTH

WAVELENGTH (LAMBDA) F(LAMBDA)	WAVELENGTH (LAMBDA) F(LAMBDA)	WAVELENGTH (LAMBDA) F(LAMBDA)	WAVELENGTH (LAMBDA) F(LAMBDA)	WAVELENGTH (LAMBDA) F(LAMBDA)	WAVELENGTH (LAMBDA) F(LAMBDA)
0.230	0.0	0.232	0.0	0.234	0.0
0.240	0.0	0.242	0.0	0.244	0.0
0.250	6.5	0.252	6.5	0.254	6.4
0.260	6.5	0.262	6.3	0.264	6.4
0.270	6.2	0.272	6.2	0.274	6.1
0.280	6.2	0.282	6.1	0.284	6.0
0.290	6.1	0.292	6.1	0.294	6.2
0.300	6.5	0.302	6.5	0.304	6.6
0.310	7.0	0.312	7.5	0.314	7.7
0.320	13.3	0.322	16.9	0.324	22.2
0.330	40.5	0.332	45.2	0.334	49.4
0.340	57.9	0.342	60.4	0.344	62.3
0.350	67.3	0.352	68.7	0.354	70.4
0.360	74.0	0.365	76.1	0.370	78.2
0.375	83.0	0.390	84.4	0.395	85.4
0.410	87.3	0.415	87.5	0.420	88.0
0.435	89.4	0.440	89.9	0.445	89.8
0.460	90.1	0.465	89.7	0.470	90.0
0.485	90.2	0.490	90.5	0.495	90.9
0.510	90.8	0.515	91.3	0.520	91.2
0.535	91.5	0.540	91.9	0.545	92.2
0.560	92.3	0.565	92.8	0.570	92.7
0.585	93.3	0.590	93.3	0.595	92.9
0.610	93.5	0.615	93.1	0.620	93.2
0.635	93.4	0.640	93.7	0.645	93.3
0.660	93.5	0.665	93.6	0.670	93.8
0.685	93.9	0.690	93.9	0.695	94.0
0.710	94.5	0.715	94.5	0.720	94.7
0.740	94.7	0.745	94.9	0.750	95.1
0.770	94.9	0.775	95.0	0.780	95.1
0.800	95.0	0.805	95.2	0.810	95.1
0.830	95.0	0.835	95.2	0.840	95.1
0.860	95.0	0.865	95.4	0.870	95.4
0.890	95.0	0.895	95.4	0.900	95.4
0.920	95.0	0.925	95.4	0.930	95.4
0.950	95.0	0.955	95.4	0.960	95.4
0.980	95.0	0.985	95.4	0.990	95.4
1.010	95.0	1.015	95.4	1.020	95.4
1.040	95.0	1.045	95.4	1.050	95.4
1.070	95.0	1.075	95.4	1.080	95.4
1.100	95.0	1.105	95.4	1.110	95.4
1.130	95.0	1.135	95.4	1.140	95.4
1.160	95.0	1.165	95.4	1.170	95.4
1.190	95.0	1.195	95.4	1.200	95.4
1.220	95.0	1.225	95.4	1.230	95.4
1.250	95.0	1.255	95.4	1.260	95.4
1.280	95.0	1.285	95.4	1.290	95.4
1.310	95.0	1.315	95.4	1.320	95.4
1.340	95.0	1.345	95.4	1.350	95.4
1.370	95.0	1.375	95.4	1.380	95.4
1.400	95.0	1.405	95.4	1.410	95.4
1.430	95.0	1.435	95.4	1.440	95.4
1.460	95.0	1.465	95.4	1.470	95.4
1.490	95.0	1.495	95.4	1.500	95.4
1.520	95.0	1.525	95.4	1.530	95.4
1.550	95.0	1.555	95.4	1.560	95.4
1.580	95.0	1.585	95.4	1.590	95.4
1.610	95.0	1.615	95.4	1.620	95.4
1.640	95.0	1.645	95.4	1.650	95.4
1.670	95.0	1.675	95.4	1.680	95.4
1.700	95.0	1.705	95.4	1.710	95.4
1.730	95.0	1.735	95.4	1.740	95.4
1.760	95.0	1.765	95.4	1.770	95.4
1.790	95.0	1.795	95.4	1.800	95.4
1.820	95.0	1.825	95.4	1.830	95.4
1.850	95.0	1.855	95.4	1.860	95.4
1.880	95.0	1.885	95.4	1.890	95.4
1.910	95.0	1.915	95.4	1.920	95.4
1.940	95.0	1.945	95.4	1.950	95.4
1.970	95.0	1.975	95.4	1.980	95.4
2.000	95.0	2.005	95.4	2.010	95.4
2.030	95.0	2.035	95.4	2.040	95.4
2.060	95.0	2.065	95.4	2.070	95.4
2.090	95.0	2.095	95.4	2.100	95.4
2.120	95.0	2.125	95.4	2.130	95.4
2.150	95.0	2.155	95.4	2.160	95.4
2.180	95.0	2.185	95.4	2.190	95.4
2.210	95.0	2.215	95.4	2.220	95.4
2.240	95.0	2.245	95.4	2.250	95.4
2.270	95.0	2.275	95.4	2.280	95.4
2.300	95.0	2.305	95.4	2.310	95.4
2.330	95.0	2.335	95.4	2.340	95.4
2.360	95.0	2.365	95.4	2.370	95.4
2.390	95.0	2.395	95.4	2.400	95.4
2.420	95.0	2.425	95.4	2.430	95.4
2.450	95.0	2.455	95.4	2.460	95.4
2.480	95.0	2.485	95.4	2.490	95.4
2.510	95.0	2.515	95.4	2.520	95.4
2.540	95.0	2.545	95.4	2.550	95.4
2.570	95.0	2.575	95.4	2.580	95.4
2.600	95.0	2.605	95.4	2.610	95.4
2.630	95.0	2.635	95.4	2.640	95.4
2.660	95.0	2.665	95.4	2.670	95.4
2.690	95.0	2.695	95.4	2.700	95.4
2.720	95.0	2.725	95.4	2.730	95.4
2.750	95.0	2.755	95.4	2.760	95.4
2.780	95.0	2.785	95.4	2.790	95.4
2.810	95.0	2.815	95.4	2.820	95.4
2.840	95.0	2.845	95.4	2.850	95.4
2.870	95.0	2.875	95.4	2.880	95.4
2.900	95.0	2.905	95.4	2.910	95.4
2.930	95.0	2.935	95.4	2.940	95.4
2.960	95.0	2.965	95.4	2.970	95.4
2.990	95.0	2.995	95.4	3.000	95.4

1002800008

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FIGURE . EFFECT OF REAL-TIME SOLAR UV, VACUUM UV, PROTONS,

AND ELECTRONS ON THE REFLECTANCE OF BK-7 CROWN GLASS IN SITU IN SITU, AFTER 313 HOURS EXPOSURE

ALPHA(S) = 0.117

VS. WAVELENGTH

HEMISPHERICAL SPECTRAL REFLECTANCE

WAVELENGTH (LAMBDAA)	F(LAMBDAA)	WAVELENGTH (LAMBDAA)	F(LAMBDAA)	WAVELENGTH (LAMBDAA)	F(LAMBDAA)	WAVELENGTH (LAMBDAA)	F(LAMBDAA)	WAVELENGTH (LAMBDAA)	F(LAMBDAA)
0.230	0.0	0.232	0.0	0.234	0.0	0.236	0.0	0.238	0.0
0.240	0.0	0.242	0.0	0.244	0.0	0.246	0.0	0.248	0.0
0.250	5.7	0.252	6.5	0.254	6.6	0.256	6.6	0.258	6.6
0.260	6.6	0.262	6.5	0.264	6.7	0.266	6.8	0.268	6.8
0.270	6.4	0.272	6.7	0.274	6.3	0.276	6.4	0.278	6.4
0.280	6.2	0.282	6.1	0.284	6.3	0.286	6.4	0.288	6.4
0.290	6.1	0.292	6.1	0.294	6.0	0.296	6.2	0.298	6.4
0.300	6.3	0.302	6.5	0.304	6.5	0.306	6.6	0.308	6.9
0.310	6.8	0.312	7.3	0.314	7.7	0.316	8.6	0.318	10.8
0.320	12.6	0.322	16.5	0.324	21.4	0.326	26.7	0.328	33.0
0.330	39.1	0.332	43.4	0.334	47.3	0.336	51.0	0.338	52.8
0.340	56.1	0.342	57.7	0.344	60.1	0.346	61.6	0.348	63.9
0.350	64.8	0.352	66.2	0.354	67.8	0.356	68.7	0.358	69.9
0.360	71.0	0.362	73.2	0.364	75.2	0.366	76.6	0.368	78.9
0.370	80.5	0.372	81.8	0.374	82.9	0.376	83.6	0.378	84.4
0.380	85.2	0.382	85.3	0.384	86.0	0.386	86.4	0.388	86.7
0.390	87.1	0.392	87.3	0.394	86.9	0.396	87.7	0.398	87.9
0.400	88.3	0.402	88.5	0.404	88.6	0.406	88.3	0.408	88.8
0.410	88.8	0.412	88.8	0.414	89.3	0.416	89.3	0.418	89.5
0.420	89.6	0.422	90.3	0.424	90.2	0.426	90.3	0.428	90.9
0.430	90.9	0.432	91.3	0.434	91.4	0.436	91.4	0.438	91.6
0.440	91.4	0.442	91.8	0.444	92.1	0.446	92.2	0.448	91.9
0.450	92.9	0.452	92.8	0.454	92.5	0.456	92.7	0.458	92.9
0.460	93.0	0.462	93.1	0.464	92.9	0.466	93.1	0.468	92.9
0.470	93.5	0.472	93.4	0.474	93.3	0.476	93.6	0.478	93.6
0.480	93.5	0.482	93.5	0.484	93.8	0.486	93.8	0.488	94.6
0.490	94.6	0.492	94.6	0.494	94.9	0.496	94.6	0.498	94.5
0.500	94.6	0.502	94.8	0.504	94.5	0.506	95.0	0.508	94.9
0.510	94.6	0.512	94.9	0.514	94.8	0.516	94.5	0.518	95.0
0.520	94.6	0.522	94.9	0.524	94.9	0.526	95.1	0.528	95.0
0.530	94.6	0.532	95.0	0.534	95.1	0.536	95.2	0.538	95.2
0.540	94.6	0.542	95.1	0.544	95.0	0.546	94.5	0.548	94.7
0.550	94.6	0.552	94.8	0.554	94.9	0.556	95.0	0.558	95.0
0.560	94.6	0.562	94.6	0.564	94.6	0.566	94.4	0.568	94.8
0.570	94.6	0.572	94.6	0.574	94.6	0.576	94.4	0.578	94.4
0.580	94.6	0.582	94.6	0.584	94.6	0.586	94.4	0.588	94.4
0.590	94.6	0.592	94.6	0.594	94.6	0.596	94.4	0.598	94.4
0.600	94.6	0.602	94.6	0.604	94.6	0.606	94.4	0.608	94.4
0.610	94.6	0.612	94.6	0.614	94.6	0.616	94.4	0.618	94.4
0.620	94.6	0.622	94.6	0.624	94.6	0.626	94.4	0.628	94.4
0.630	94.6	0.632	94.6	0.634	94.6	0.636	94.4	0.638	94.4
0.640	94.6	0.642	94.6	0.644	94.6	0.646	94.4	0.648	94.4
0.650	94.6	0.652	94.6	0.654	94.6	0.656	94.4	0.658	94.4
0.660	94.6	0.662	94.6	0.664	94.6	0.666	94.4	0.668	94.4
0.670	94.6	0.672	94.6	0.674	94.6	0.676	94.4	0.678	94.4
0.680	94.6	0.682	94.6	0.684	94.6	0.686	94.4	0.688	94.4
0.690	94.6	0.692	94.6	0.694	94.6	0.696	94.4	0.698	94.4
0.700	94.6	0.702	94.6	0.704	94.6	0.706	94.4	0.708	94.4
0.710	94.6	0.712	94.6	0.714	94.6	0.716	94.4	0.718	94.4
0.720	94.6	0.722	94.6	0.724	94.6	0.726	94.4	0.728	94.4
0.730	94.6	0.732	94.6	0.734	94.6	0.736	94.4	0.738	94.4
0.740	94.6	0.742	94.6	0.744	94.6	0.746	94.4	0.748	94.4
0.750	94.6	0.752	94.6	0.754	94.6	0.756	94.4	0.758	94.4
0.760	94.6	0.762	94.6	0.764	94.6	0.766	94.4	0.768	94.4
0.770	94.6	0.772	94.6	0.774	94.6	0.776	94.4	0.778	94.4
0.780	94.6	0.782	94.6	0.784	94.6	0.786	94.4	0.788	94.4
0.790	94.6	0.792	94.6	0.794	94.6	0.796	94.4	0.798	94.4
0.800	94.6	0.802	94.6	0.804	94.6	0.806	94.4	0.808	94.4
0.810	94.6	0.812	94.6	0.814	94.6	0.816	94.4	0.818	94.4
0.820	94.6	0.822	94.6	0.824	94.6	0.826	94.4	0.828	94.4
0.830	94.6	0.832	94.6	0.834	94.6	0.836	94.4	0.838	94.4
0.840	94.6	0.842	94.6	0.844	94.6	0.846	94.4	0.848	94.4
0.850	94.6	0.852	94.6	0.854	94.6	0.856	94.4	0.858	94.4
0.860	94.6	0.862	94.6	0.864	94.6	0.866	94.4	0.868	94.4
0.870	94.6	0.872	94.6	0.874	94.6	0.876	94.4	0.878	94.4
0.880	94.6	0.882	94.6	0.884	94.6	0.886	94.4	0.888	94.4
0.890	94.6	0.892	94.6	0.894	94.6	0.896	94.4	0.898	94.4
0.900	94.6	0.902	94.6	0.904	94.6	0.906	94.4	0.908	94.4
0.910	94.6	0.912	94.6	0.914	94.6	0.916	94.4	0.918	94.4
0.920	94.6	0.922	94.6	0.924	94.6	0.926	94.4	0.928	94.4
0.930	94.6	0.932	94.6	0.934	94.6	0.936	94.4	0.938	94.4
0.940	94.6	0.942	94.6	0.944	94.6	0.946	94.4	0.948	94.4
0.950	94.6	0.952	94.6	0.954	94.6	0.956	94.4	0.958	94.4
0.960	94.6	0.962	94.6	0.964	94.6	0.966	94.4	0.968	94.4
0.970	94.6	0.972	94.6	0.974	94.6	0.976	94.4	0.978	94.4
0.980	94.6	0.982	94.6	0.984	94.6	0.986	94.4	0.988	94.4
0.990	94.6	0.992	94.6	0.994	94.6	0.996	94.4	0.998	94.4
1.000	94.6	1.002	94.6	1.004	94.6	1.006	94.4	1.008	94.4
1.010	94.6	1.012	94.6	1.014	94.6	1.016	94.4	1.018	94.4
1.020	94.6	1.022	94.6	1.024	94.6	1.026	94.4	1.028	94.4
1.030	94.6	1.032	94.6	1.034	94.6	1.036	94.4	1.038	94.4
1.040	94.6	1.042	94.6	1.044	94.6	1.046	94.4	1.048	94.4
1.050	94.6	1.052	94.6	1.054	94.6	1.056	94.4	1.058	94.4
1.060	94.6	1.062	94.6	1.064	94.6	1.066	94.4	1.068	94.4
1.070	94.6	1.072	94.6	1.074	94.6	1.076	94.4	1.078	94.4
1.080	94.6	1.082	94.6	1.084	94.6	1.086	94.4	1.088	94.4
1.090	94.6	1.092	94.6	1.094	94.6	1.096	94.4	1.098	94.4
1.100	94.6	1.102	94.6	1.104	94.6	1.106	94.4	1.108	94.4
1.110	94.6	1.112	94.6	1.114	94.6	1.116	94.4	1.118	94.4
1.120	94.6	1.122	94.6	1.124	94.6	1.126	94.4	1.128	94.4
1.130	94.6	1.132	94.6	1.134	94.6	1.136	94.4	1.138	94.4
1.140	94.6	1.142	94.6	1.144	94.6	1.146	94.4	1.148	94.4
1.150	94.6	1.152	94.6	1.154	94.6	1.156	94.4	1.158	94.4
1.160	94.6	1.162	94.6	1.164	94.6	1.166	94.4	1.168	94.4
1.170	94.6	1.172	94.6	1.174	94.6	1.176	94.4	1.178	94.4
1.180	94.6	1.182	94.6	1.184	94.6	1.186	94.4	1.188	94.4
1.190	94.6	1.192	94.6	1.194	94.6	1.196	94.4	1.198	94.4
1.200	94.6	1.202	94.6	1.204	94.6	1.206	94.4	1.208	94.4
1.210	94.6	1.212	94.6	1.214	94.6	1.216	94.4	1.218	94.4
1.220	94.6	1.222	94.6	1.224	94.6	1.226	94.4	1.228	94.4
1.230	94.6	1.232	94.6	1.234	94.6	1.236	94.4	1.238	94.4
1.240	94.6	1.242	94.6	1.244	94.6	1.246	94.4	1.248	94.4
1.250	94.6	1.252	94.6	1.254	94.6	1.256	94.4	1.258	94.4
1.260	94.6	1.262	94.6	1.264	94.6	1.266	94.4	1.268	94.4
1.270	94.6	1.272	94.6	1.274	94.6	1.276	94.4	1.278	94.4
1.280	94.6	1.282	94.6	1.284	94.6	1.286	94.4	1.288	94.4
1.290	94.6	1.292	94.6	1.294	94.6	1.296	94.4	1.298	94.4
1.300									

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| HEMISPHERICAL SPECTRAL REFLECTANCE | | | | VS. WAVELENGTH | | | | ALPHA(S) = 0.078 | | | |
|------------------------------------|-----------|------------------------|-----------|------------------------|-----------|------------------------|-----------|------------------------|-----------|------------------------|-----------|
| WAVELENGTH
(LAMBDA) | F(LAMBDA) | WAVELENGTH
(LAMBDA) | F(LAMBDA) | WAVELENGTH
(LAMBDA) | F(LAMBDA) | WAVELENGTH
(LAMBDA) | F(LAMBDA) | WAVELENGTH
(LAMBDA) | F(LAMBDA) | WAVELENGTH
(LAMBDA) | F(LAMBDA) |
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 | 0.240 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 | 0.250 | 0.0 |
| 0.250 | 21.6 | 0.252 | 21.5 | 0.254 | 21.4 | 0.256 | 21.4 | 0.258 | 21.4 | 0.260 | 21.4 |
| 0.260 | 20.9 | 0.262 | 20.9 | 0.264 | 20.5 | 0.266 | 20.5 | 0.268 | 20.3 | 0.270 | 20.2 |
| 0.270 | 19.9 | 0.272 | 19.6 | 0.274 | 19.6 | 0.276 | 19.1 | 0.278 | 18.7 | 0.280 | 18.2 |
| 0.280 | 18.0 | 0.282 | 17.6 | 0.284 | 16.9 | 0.286 | 16.5 | 0.288 | 16.5 | 0.290 | 15.9 |
| 0.290 | 15.6 | 0.292 | 15.0 | 0.294 | 14.2 | 0.296 | 13.4 | 0.298 | 12.8 | 0.300 | 12.0 |
| 0.300 | 11.6 | 0.302 | 10.9 | 0.304 | 9.9 | 0.306 | 9.2 | 0.308 | 8.7 | 0.310 | 8.2 |
| 0.310 | 8.3 | 0.312 | 8.6 | 0.314 | 9.3 | 0.316 | 10.4 | 0.318 | 12.9 | 0.320 | 12.9 |
| 0.320 | 17.0 | 0.322 | 23.0 | 0.324 | 30.2 | 0.326 | 31.2 | 0.328 | 40.3 | 0.330 | 40.3 |
| 0.330 | 54.6 | 0.332 | 63.2 | 0.334 | 67.4 | 0.336 | 70.2 | 0.338 | 73.7 | 0.340 | 73.7 |
| 0.340 | 75.4 | 0.342 | 77.8 | 0.344 | 79.4 | 0.346 | 81.2 | 0.348 | 82.1 | 0.350 | 82.1 |
| 0.350 | 82.7 | 0.352 | 83.8 | 0.354 | 84.1 | 0.356 | 85.3 | 0.358 | 86.8 | 0.360 | 86.8 |
| 0.360 | 86.9 | 0.365 | 98.6 | 0.370 | 89.5 | 0.375 | 91.3 | 0.380 | 91.3 | 0.385 | 91.3 |
| 0.385 | 92.5 | 0.390 | 92.9 | 0.395 | 93.1 | 0.400 | 93.6 | 0.405 | 93.7 | 0.410 | 93.7 |
| 0.410 | 94.3 | 0.415 | 94.8 | 0.420 | 95.2 | 0.425 | 95.1 | 0.430 | 95.7 | 0.435 | 95.9 |
| 0.435 | 95.7 | 0.440 | 95.9 | 0.445 | 95.2 | 0.450 | 95.5 | 0.455 | 95.9 | 0.460 | 95.9 |
| 0.460 | 96.0 | 0.465 | 95.7 | 0.470 | 95.5 | 0.475 | 95.3 | 0.480 | 95.6 | 0.485 | 95.6 |
| 0.485 | 95.2 | 0.490 | 95.6 | 0.495 | 95.4 | 0.500 | 95.4 | 0.505 | 95.8 | 0.510 | 95.8 |
| 0.510 | 95.0 | 0.515 | 95.2 | 0.520 | 95.3 | 0.525 | 95.3 | 0.530 | 95.7 | 0.535 | 95.8 |
| 0.535 | 95.6 | 0.540 | 95.8 | 0.545 | 95.5 | 0.550 | 95.3 | 0.555 | 95.8 | 0.560 | 95.8 |
| 0.560 | 95.7 | 0.565 | 95.8 | 0.570 | 95.9 | 0.575 | 95.9 | 0.580 | 95.9 | 0.585 | 95.9 |
| 0.585 | 96.3 | 0.590 | 96.1 | 0.595 | 96.1 | 0.600 | 96.2 | 0.605 | 96.0 | 0.610 | 96.0 |
| 0.610 | 96.0 | 0.615 | 96.2 | 0.620 | 95.9 | 0.625 | 96.1 | 0.630 | 96.0 | 0.635 | 96.0 |
| 0.635 | 96.0 | 0.640 | 96.0 | 0.645 | 96.1 | 0.650 | 95.8 | 0.655 | 95.6 | 0.660 | 95.6 |
| 0.660 | 96.0 | 0.665 | 96.0 | 0.670 | 95.9 | 0.675 | 95.9 | 0.680 | 95.9 | 0.685 | 95.9 |
| 0.685 | 95.8 | 0.690 | 95.7 | 0.695 | 96.0 | 0.700 | 95.9 | 0.705 | 95.5 | 0.710 | 95.5 |
| 0.710 | 95.7 | 0.715 | 95.6 | 0.720 | 95.5 | 0.725 | 95.4 | 0.730 | 95.7 | 0.735 | 95.7 |
| 0.735 | 95.4 | 0.740 | 95.7 | 0.745 | 95.7 | 0.750 | 95.7 | 0.755 | 95.9 | 0.760 | 95.9 |
| 0.760 | 95.5 | 0.765 | 95.8 | 0.770 | 95.9 | 0.775 | 95.9 | 0.780 | 95.9 | 0.785 | 95.9 |
| 0.785 | 95.5 | 0.790 | 95.8 | 0.795 | 95.8 | 0.800 | 95.7 | 0.805 | 95.7 | 0.810 | 95.7 |
| 0.810 | 95.6 | 0.815 | 95.8 | 0.820 | 95.9 | 0.825 | 95.9 | 0.830 | 95.9 | 0.835 | 95.9 |
| 0.835 | 95.7 | 0.840 | 95.9 | 0.845 | 95.9 | 0.850 | 95.9 | | | | |

FIGURE 1. EFFECT OF REAL-TIME 90° AR UV, VACUUM UV, PROTONS,

AND ELECTRONS ON THE REFLECTANCE OF 7940 FUSED SILICA IN SITU
IN SITU, AFTER 50 HOURS EXPOSURE

| HEMISPHERICAL SPECTRAL REFLECTANCE | | | VS. WAVELENGTH | | | ALPHA(8) = 0.08 | | | |
|------------------------------------|-----------|------------------------|----------------|------------------------|-----------|------------------------|-----------|------------------------|-----------|
| WAVELENGTH
(LAMRDA) | F(LAMBDA) | WAVELENGTH
(LAMRDA) | F(LAMBDA) | WAVELENGTH
(LAMRDA) | F(LAMBDA) | WAVELENGTH
(LAMRDA) | F(LAMBDA) | WAVELENGTH
(LAMRDA) | F(LAMBDA) |
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 |
| 0.250 | 21.6 | 0.252 | 21.5 | 0.254 | 21.4 | 0.256 | 21.2 | 0.258 | 21.0 |
| 0.260 | 20.9 | 0.262 | 20.7 | 0.264 | 20.5 | 0.266 | 20.3 | 0.268 | 19.9 |
| 0.270 | 19.9 | 0.272 | 19.4 | 0.274 | 18.9 | 0.276 | 18.7 | 0.278 | 18.2 |
| 0.280 | 17.8 | 0.282 | 17.5 | 0.284 | 16.9 | 0.286 | 16.4 | 0.288 | 16.0 |
| 0.290 | 15.3 | 0.292 | 14.9 | 0.294 | 14.1 | 0.296 | 13.3 | 0.298 | 12.7 |
| 0.300 | 11.7 | 0.302 | 10.7 | 0.304 | 9.7 | 0.306 | 9.0 | 0.308 | 8.6 |
| 0.310 | 8.4 | 0.312 | 8.5 | 0.314 | 9.2 | 0.316 | 10.3 | 0.318 | 13.0 |
| 0.320 | 16.8 | 0.322 | 22.6 | 0.324 | 30.1 | 0.326 | 39.1 | 0.328 | 48.0 |
| 0.330 | 56.3 | 0.332 | 62.8 | 0.334 | 71.1 | 0.336 | 70.5 | 0.338 | 73.5 |
| 0.340 | 75.8 | 0.342 | 77.0 | 0.344 | 79.1 | 0.346 | 80.2 | 0.348 | 81.1 |
| 0.350 | 92.0 | 0.352 | 83.8 | 0.354 | 84.3 | 0.356 | 85.5 | 0.358 | 86.0 |
| 0.360 | 86.0 | 0.365 | 87.3 | 0.370 | 88.5 | 0.375 | 89.1 | 0.380 | 90.5 |
| 0.385 | 91.3 | 0.390 | 91.4 | 0.395 | 92.0 | 0.400 | 92.5 | 0.405 | 93.1 |
| 0.410 | 93.5 | 0.415 | 93.6 | 0.420 | 94.0 | 0.425 | 94.2 | 0.430 | 94.7 |
| 0.435 | 94.8 | 0.440 | 95.1 | 0.445 | 94.6 | 0.450 | 95.1 | 0.455 | 95.3 |
| 0.460 | 94.8 | 0.465 | 95.1 | 0.470 | 94.6 | 0.475 | 94.6 | 0.480 | 95.0 |
| 0.485 | 94.8 | 0.490 | 94.5 | 0.495 | 95.0 | 0.500 | 94.4 | 0.505 | 95.2 |
| 0.510 | 94.8 | 0.515 | 95.2 | 0.520 | 94.9 | 0.525 | 94.8 | 0.530 | 95.0 |
| 0.535 | 95.1 | 0.540 | 95.2 | 0.545 | 95.1 | 0.550 | 95.4 | 0.555 | 95.5 |
| 0.560 | 95.1 | 0.565 | 95.9 | 0.570 | 95.8 | 0.575 | 95.3 | 0.580 | 95.8 |
| 0.585 | 96.1 | 0.590 | 96.2 | 0.595 | 95.7 | 0.600 | 96.1 | 0.605 | 95.7 |
| 0.610 | 95.4 | 0.615 | 95.7 | 0.620 | 96.0 | 0.625 | 96.0 | 0.630 | 95.7 |
| 0.635 | 95.7 | 0.640 | 95.7 | 0.645 | 95.4 | 0.650 | 95.9 | 0.655 | 95.4 |
| 0.660 | 96.0 | 0.665 | 95.7 | 0.670 | 95.6 | 0.675 | 95.9 | 0.680 | 95.7 |
| 0.685 | 95.9 | 0.690 | 95.8 | 0.695 | 95.8 | 0.700 | 96.0 | 0.720 | 95.8 |
| 0.740 | 95.7 | 0.760 | 95.8 | 0.780 | 95.9 | 0.800 | 95.5 | 0.820 | 95.5 |
| 0.840 | 95.4 | 0.860 | 95.5 | 0.880 | 95.5 | 0.900 | 95.7 | 0.920 | 95.7 |
| 0.940 | 95.5 | 0.960 | 95.9 | 0.980 | 95.8 | 1.000 | 95.7 | 1.020 | 95.9 |
| 1.040 | 95.6 | 1.060 | 95.8 | 1.080 | 95.9 | 1.100 | 96.1 | 1.120 | 95.9 |
| 1.140 | 95.7 | 1.160 | 95.8 | 1.180 | 95.8 | 1.200 | 95.8 | 1.220 | 95.8 |
| 1.240 | 95.8 | 1.260 | 95.8 | 1.280 | 95.6 | 1.300 | 95.6 | 1.320 | 94.7 |
| 1.340 | 92.7 | 1.360 | 92.2 | 1.380 | 93.7 | 1.400 | 95.4 | 1.420 | 95.8 |
| 1.440 | 95.9 | 1.460 | 96.0 | 1.480 | 96.0 | 1.500 | 96.2 | 1.520 | 96.1 |
| 1.540 | 96.0 | 1.560 | 96.0 | 1.580 | 96.2 | 1.600 | 96.1 | 1.620 | 96.2 |
| 1.640 | 96.3 | 1.660 | 96.2 | 1.680 | 96.3 | 1.700 | 96.2 | 1.720 | 96.1 |
| 1.740 | 96.4 | 1.760 | 96.2 | 1.780 | 96.1 | 1.800 | 96.1 | 1.820 | 96.1 |
| 1.840 | 96.1 | 1.860 | 96.3 | 1.880 | 96.3 | 1.900 | 96.5 | 1.920 | 96.4 |
| 1.940 | 96.6 | 1.960 | 96.4 | 1.980 | 96.3 | 2.000 | 96.2 | 2.020 | 95.7 |
| 2.040 | 95.5 | 2.060 | 95.6 | 2.080 | 95.4 | 2.100 | 94.9 | 2.120 | 94.1 |
| 2.140 | 92.0 | 2.160 | 88.1 | 2.180 | 83.6 | 2.200 | 79.9 | 2.220 | 79.3 |
| 2.240 | 81.3 | 2.260 | 84.8 | 2.280 | 84.2 | 2.300 | 90.7 | 2.320 | 92.5 |
| 2.340 | 93.1 | 2.360 | 93.4 | 2.380 | 92.9 | 2.400 | 92.1 | 2.420 | 91.0 |
| 2.440 | 89.5 | 2.460 | 86.2 | 2.480 | 85.8 | 2.500 | 83.5 | | |

FIGURE 1. EFFECT OF REAL-TIME SOLAR UV, VACUUM UV, PROTONS, 401

AND ELECTRONS ON THE REFLECTANCE OF 7980 FUSED SILICA IN SITU

ALPHA(8) = 0.007

| WAVELENGTH
(λ Å) | F (λ Å) | WAVELENGTH
(λ Å) | F (λ Å) | WAVELENGTH
(λ Å) | F (λ Å) | WAVELENGTH
(λ Å) | F (λ Å) |
|------------------------------|------------------|------------------------------|------------------|------------------------------|------------------|------------------------------|------------------|
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 |
| 0.250 | 20.5 | 0.252 | 20.1 | 0.254 | 20.1 | 0.256 | 20.2 |
| 0.260 | 19.8 | 0.262 | 19.9 | 0.264 | 19.8 | 0.266 | 19.3 |
| 0.270 | 18.6 | 0.272 | 18.6 | 0.274 | 18.5 | 0.276 | 18.1 |
| 0.280 | 17.2 | 0.282 | 16.7 | 0.284 | 16.4 | 0.286 | 15.9 |
| 0.290 | 15.1 | 0.292 | 14.5 | 0.294 | 14.1 | 0.296 | 13.3 |
| 0.300 | 11.7 | 0.302 | 10.9 | 0.304 | 10.0 | 0.306 | 9.4 |
| 0.310 | 8.7 | 0.312 | 8.0 | 0.314 | 9.5 | 0.316 | 10.6 |
| 0.320 | 17.2 | 0.322 | 22.4 | 0.324 | 29.8 | 0.326 | 38.4 |
| 0.330 | 54.2 | 0.332 | 59.7 | 0.334 | 63.5 | 0.336 | 67.2 |
| 0.340 | 72.2 | 0.342 | 73.3 | 0.344 | 75.0 | 0.346 | 74.4 |
| 0.350 | 78.0 | 0.352 | 79.6 | 0.354 | 79.8 | 0.356 | 81.3 |
| 0.360 | 82.6 | 0.365 | 84.1 | 0.370 | 85.3 | 0.375 | 86.2 |
| 0.375 | 88.1 | 0.390 | 89.2 | 0.395 | 89.6 | 0.400 | 90.1 |
| 0.410 | 91.3 | 0.415 | 91.6 | 0.420 | 92.1 | 0.425 | 92.2 |
| 0.435 | 92.8 | 0.440 | 93.0 | 0.445 | 93.1 | 0.450 | 93.4 |
| 0.460 | 93.9 | 0.465 | 93.5 | 0.470 | 93.7 | 0.475 | 93.7 |
| 0.485 | 93.7 | 0.490 | 93.6 | 0.495 | 94.1 | 0.500 | 93.3 |
| 0.510 | 94.0 | 0.515 | 94.0 | 0.520 | 94.1 | 0.525 | 94.3 |
| 0.535 | 94.2 | 0.540 | 94.9 | 0.545 | 95.1 | 0.550 | 94.8 |
| 0.560 | 94.7 | 0.565 | 95.1 | 0.570 | 95.2 | 0.575 | 95.3 |
| 0.585 | 95.9 | 0.590 | 96.0 | 0.595 | 95.2 | 0.600 | 95.6 |
| 0.610 | 95.6 | 0.615 | 95.1 | 0.620 | 95.4 | 0.625 | 95.4 |
| 0.635 | 95.8 | 0.640 | 95.0 | 0.645 | 95.0 | 0.650 | 95.2 |
| 0.665 | 95.5 | 0.665 | 94.8 | 0.670 | 95.1 | 0.675 | 95.5 |
| 0.685 | 95.4 | 0.690 | 95.1 | 0.695 | 95.4 | 0.700 | 95.4 |
| 0.740 | 95.1 | 0.760 | 95.0 | 0.760 | 95.1 | 0.800 | 95.0 |
| 0.800 | 95.2 | 0.860 | 95.0 | 0.880 | 95.4 | 0.900 | 95.4 |
| 0.900 | 95.2 | 0.960 | 95.0 | 0.980 | 95.7 | 1.000 | 95.5 |
| 1.040 | 95.4 | 1.060 | 95.7 | 1.080 | 95.6 | 1.100 | 95.9 |
| 1.140 | 95.6 | 1.160 | 95.8 | 1.180 | 95.6 | 1.200 | 95.7 |
| 1.240 | 95.8 | 1.260 | 95.8 | 1.280 | 95.7 | 1.300 | 95.8 |
| 1.340 | 92.9 | 1.360 | 92.3 | 1.380 | 93.4 | 1.400 | 95.3 |
| 1.440 | 95.8 | 1.460 | 95.9 | 1.480 | 95.9 | 1.500 | 96.1 |
| 1.540 | 96.1 | 1.560 | 96.1 | 1.580 | 96.2 | 1.600 | 96.0 |
| 1.640 | 96.1 | 1.660 | 96.1 | 1.680 | 96.2 | 1.700 | 96.1 |
| 1.740 | 96.3 | 1.760 | 96.2 | 1.780 | 96.2 | 1.800 | 96.1 |
| 1.840 | 96.1 | 1.860 | 96.3 | 1.880 | 96.2 | 1.900 | 96.4 |
| 1.940 | 96.0 | 1.960 | 94.2 | 1.980 | 96.2 | 2.000 | 96.1 |
| 2.040 | 95.6 | 2.060 | 95.5 | 2.080 | 95.5 | 2.100 | 94.9 |
| 2.140 | 91.7 | 2.160 | 88.0 | 2.180 | 83.9 | 2.200 | 80.9 |
| 2.240 | 92.4 | 2.260 | 81.4 | 2.280 | 87.6 | 2.300 | 90.4 |
| 2.340 | 92.0 | 2.360 | 93.1 | 2.380 | 92.7 | 2.400 | 91.8 |
| 2.440 | 89.2 | 2.460 | 87.8 | 2.480 | 85.7 | 2.500 | 83.5 |

FIGURE 3, EFFECT OF REAL-TIME SOLAR UV, VACUUM UV, PROTONS, S-1
AND ELECTRONS ON THE REFLECTANCE OF SAPPHIRE IN SITU IN VACUUM, BEFORE EXPOSURE

| HEMISPHERICAL SPECTRAL REFLECTANCE | | | | VS. WAVELENGTH | | | | ALPHA(18) = 0.10 | | | |
|------------------------------------|-----------|-------------------------|-----------|-------------------------|-----------|-------------------------|-----------|-------------------------|-----------|-------------------------|-----------|
| WAVELENGTH
(LAMBDAA) | F(LAMBDA) | WAVELENGTH
(LAMBDAA) | F(LAMBDA) | WAVELENGTH
(LAMBDAA) | F(LAMBDA) | WAVELENGTH
(LAMBDAA) | F(LAMBDA) | WAVELENGTH
(LAMBDAA) | F(LAMBDA) | WAVELENGTH
(LAMBDAA) | F(LAMBDA) |
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 | 0.240 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 | 0.250 | 20.2 |
| 0.250 | 20.6 | 0.252 | 20.5 | 0.254 | 20.5 | 0.256 | 20.4 | 0.258 | 20.4 | 0.260 | 19.5 |
| 0.260 | 20.3 | 0.262 | 20.1 | 0.264 | 20.0 | 0.266 | 19.8 | 0.268 | 19.5 | 0.270 | 18.2 |
| 0.270 | 19.2 | 0.272 | 19.2 | 0.274 | 18.9 | 0.276 | 18.9 | 0.278 | 18.5 | 0.280 | 16.4 |
| 0.280 | 17.9 | 0.282 | 17.7 | 0.284 | 17.2 | 0.286 | 17.0 | 0.288 | 17.0 | 0.290 | 14.2 |
| 0.290 | 16.2 | 0.292 | 15.6 | 0.294 | 15.3 | 0.296 | 14.6 | 0.298 | 14.6 | 0.300 | 12.3 |
| 0.300 | 13.0 | 0.302 | 13.1 | 0.304 | 12.7 | 0.306 | 12.4 | 0.308 | 12.3 | 0.310 | 10.3 |
| 0.310 | 12.3 | 0.312 | 11.2 | 0.314 | 10.2 | 0.316 | 10.0 | 0.318 | 10.3 | 0.320 | 08.6 |
| 0.320 | 22.2 | 0.322 | 27.8 | 0.324 | 34.0 | 0.326 | 41.8 | 0.328 | 48.6 | 0.330 | 48.6 |
| 0.330 | 54.8 | 0.332 | 59.4 | 0.334 | 62.6 | 0.336 | 63.9 | 0.338 | 66.0 | 0.340 | 70.6 |
| 0.340 | 67.5 | 0.342 | 68.1 | 0.344 | 69.3 | 0.346 | 70.0 | 0.348 | 70.6 | 0.350 | 73.4 |
| 0.350 | 71.2 | 0.352 | 71.5 | 0.354 | 71.7 | 0.356 | 72.4 | 0.358 | 73.4 | 0.360 | 76.7 |
| 0.360 | 73.3 | 0.362 | 74.0 | 0.364 | 74.8 | 0.366 | 75.7 | 0.368 | 76.7 | 0.370 | 81.0 |
| 0.370 | 78.1 | 0.372 | 78.6 | 0.374 | 79.5 | 0.376 | 80.4 | 0.378 | 81.0 | 0.380 | 85.4 |
| 0.380 | 82.2 | 0.382 | 83.0 | 0.384 | 83.6 | 0.386 | 84.2 | 0.388 | 85.4 | 0.400 | 88.9 |
| 0.400 | 85.6 | 0.402 | 86.7 | 0.404 | 87.3 | 0.406 | 87.9 | 0.408 | 88.9 | 0.410 | 89.9 |
| 0.410 | 88.2 | 0.412 | 88.2 | 0.414 | 88.3 | 0.416 | 88.2 | 0.418 | 89.9 | 0.420 | 90.5 |
| 0.420 | 89.9 | 0.422 | 89.3 | 0.424 | 89.1 | 0.426 | 89.6 | 0.428 | 90.3 | 0.430 | 91.4 |
| 0.430 | 89.6 | 0.432 | 90.0 | 0.434 | 90.0 | 0.436 | 90.8 | 0.438 | 91.4 | 0.440 | 92.2 |
| 0.440 | 91.8 | 0.442 | 91.8 | 0.444 | 91.7 | 0.446 | 92.1 | 0.448 | 92.2 | 0.450 | 92.6 |
| 0.450 | 92.7 | 0.452 | 92.6 | 0.454 | 92.3 | 0.456 | 92.7 | 0.458 | 92.6 | 0.460 | 93.2 |
| 0.460 | 92.9 | 0.462 | 92.9 | 0.464 | 92.9 | 0.466 | 93.2 | 0.468 | 93.0 | 0.470 | 92.9 |
| 0.470 | 93.0 | 0.472 | 93.0 | 0.474 | 93.2 | 0.476 | 93.0 | 0.478 | 92.9 | 0.480 | 93.1 |
| 0.480 | 93.1 | 0.482 | 93.0 | 0.484 | 92.9 | 0.486 | 92.9 | 0.488 | 92.9 | 0.490 | 93.4 |
| 0.490 | 93.0 | 0.492 | 93.0 | 0.494 | 93.0 | 0.496 | 93.3 | 0.498 | 93.3 | 0.500 | 94.1 |
| 0.500 | 93.5 | 0.502 | 93.6 | 0.504 | 93.8 | 0.506 | 94.0 | 0.508 | 94.0 | 0.510 | 94.4 |
| 0.510 | 94.0 | 0.512 | 94.3 | 0.514 | 94.4 | 0.516 | 94.4 | 0.518 | 94.4 | 0.520 | 94.4 |
| 0.520 | 94.7 | 0.522 | 94.7 | 0.524 | 94.4 | 0.526 | 94.4 | 0.528 | 94.4 | 0.530 | 94.5 |
| 0.530 | 94.7 | 0.532 | 94.7 | 0.534 | 94.4 | 0.536 | 94.4 | 0.538 | 94.4 | 0.540 | 94.5 |
| 0.540 | 94.8 | 0.542 | 94.8 | 0.544 | 94.8 | 0.546 | 94.8 | 0.548 | 94.8 | 0.550 | 94.9 |
| 0.550 | 94.9 | 0.552 | 94.8 | 0.554 | 94.8 | 0.556 | 95.0 | 0.558 | 95.0 | 0.560 | 95.0 |
| 0.560 | 94.8 | 0.562 | 94.8 | 0.564 | 95.0 | 0.566 | 95.0 | 0.568 | 95.0 | 0.570 | 95.1 |
| 0.570 | 95.2 | 0.572 | 95.2 | 0.574 | 95.2 | 0.576 | 95.1 | 0.578 | 95.1 | 0.580 | 95.1 |
| 0.580 | 95.2 | 0.582 | 95.2 | 0.584 | 95.3 | 0.586 | 95.3 | 0.588 | 95.3 | 0.590 | 95.6 |
| 0.590 | 95.9 | 0.592 | 95.9 | 0.594 | 95.6 | 0.596 | 95.6 | 0.598 | 95.6 | 0.600 | 95.7 |
| 0.600 | 95.7 | 0.602 | 95.7 | 0.604 | 95.7 | 0.606 | 95.6 | 0.608 | 95.6 | 0.610 | 95.7 |
| 0.610 | 95.7 | 0.612 | 95.7 | 0.614 | 95.7 | 0.616 | 95.6 | 0.618 | 95.6 | 0.620 | 95.7 |
| 0.620 | 95.5 | 0.622 | 95.5 | 0.624 | 95.5 | 0.626 | 95.5 | 0.628 | 95.5 | 0.630 | 95.7 |
| 0.630 | 95.5 | 0.632 | 95.5 | 0.634 | 95.5 | 0.636 | 95.5 | 0.638 | 95.5 | 0.640 | 95.7 |
| 0.640 | 95.5 | 0.642 | 95.5 | 0.644 | 95.5 | 0.646 | 95.5 | 0.648 | 95.5 | 0.650 | 95.7 |
| 0.650 | 95.5 | 0.652 | 95.5 | 0.654 | 95.5 | 0.656 | 95.5 | 0.658 | 95.5 | 0.660 | 95.7 |
| 0.660 | 95.5 | 0.662 | 95.5 | 0.664 | 95.5 | 0.666 | 95.5 | 0.668 | 95.5 | 0.670 | 95.7 |
| 0.670 | 95.5 | 0.672 | 95.5 | 0.674 | 95.5 | 0.676 | 95.5 | 0.678 | 95.5 | 0.680 | 95.7 |
| 0.680 | 95.5 | 0.682 | 95.5 | 0.684 | 95.5 | 0.686 | 95.5 | 0.688 | 95.5 | 0.690 | 95.7 |
| 0.690 | 95.5 | 0.692 | 95.5 | 0.694 | 95.5 | 0.696 | 95.5 | 0.698 | 95.5 | 0.700 | 95.7 |
| 0.700 | 95.5 | 0.702 | 95.5 | 0.704 | 95.5 | 0.706 | 95.5 | 0.708 | 95.5 | 0.710 | 95.7 |
| 0.710 | 95.5 | 0.712 | 95.5 | 0.714 | 95.5 | 0.716 | 95.5 | 0.718 | 95.5 | 0.720 | 95.7 |
| 0.720 | 95.5 | 0.722 | 95.5 | 0.724 | 95.5 | 0.726 | 95.5 | 0.728 | 95.5 | 0.730 | 95.7 |
| 0.730 | 95.5 | 0.732 | 95.5 | 0.734 | 95.5 | 0.736 | 95.5 | 0.738 | 95.5 | 0.740 | 95.7 |
| 0.740 | 95.5 | 0.742 | 95.5 | 0.744 | 95.5 | 0.746 | 95.5 | 0.748 | 95.5 | 0.750 | 95.7 |
| 0.750 | 95.5 | 0.752 | 95.5 | 0.754 | 95.5 | 0.756 | 95.5 | 0.758 | 95.5 | 0.760 | 95.7 |
| 0.760 | 95.5 | 0.762 | 95.5 | 0.764 | 95.5 | 0.766 | 95.5 | 0.768 | 95.5 | 0.770 | 95.7 |
| 0.770 | 95.5 | 0.772 | 95.5 | 0.774 | 95.5 | 0.776 | 95.5 | 0.778 | 95.5 | 0.780 | 95.7 |
| 0.780 | 95.5 | 0.782 | 95.5 | 0.784 | 95.5 | 0.786 | 95.5 | 0.788 | 95.5 | 0.790 | 95.7 |
| 0.790 | 95.5 | 0.792 | 95.5 | 0.794 | 95.5 | 0.796 | 95.5 | 0.798 | 95.5 | 0.800 | 95.7 |
| 0.800 | 95.5 | 0.802 | 95.5 | 0.804 | 95.5 | 0.806 | 95.5 | 0.808 | 95.5 | 0.810 | 95.7 |
| 0.810 | 95.5 | 0.812 | 95.5 | 0.814 | 95.5 | 0.816 | 95.5 | 0.818 | 95.5 | 0.820 | 95.7 |
| 0.820 | 95.5 | 0.822 | 95.5 | 0.824 | 95.5 | 0.826 | 95.5 | 0.828 | 95.5 | 0.830 | 95.7 |
| 0.830 | 95.5 | 0.832 | 95.5 | 0.834 | 95.5 | 0.836 | 95.5 | 0.838 | 95.5 | 0.840 | 95.7 |
| 0.840 | 95.5 | 0.842 | 95.5 | 0.844 | 95.5 | 0.846 | 95.5 | 0.848 | 95.5 | 0.850 | 95.7 |
| 0.850 | 95.5 | 0.852 | 95.5 | 0.854 | 95.5 | 0.856 | 95.5 | 0.858 | 95.5 | 0.860 | 95.7 |
| 0.860 | 95.5 | 0.862 | 95.5 | 0.864 | 95.5 | 0.866 | 95.5 | 0.868 | 95.5 | 0.870 | 95.7 |
| 0.870 | 95.5 | 0.872 | 95.5 | 0.874 | 95.5 | 0.876 | 95.5 | 0.878 | 95.5 | 0.880 | 95.7 |
| 0.880 | 95.5 | 0.882 | 95.5 | 0.884 | 95.5 | 0.886 | 95.5 | 0.888 | 95.5 | 0.890 | 95.7 |
| 0.890 | 95.5 | 0.892 | 95.5 | 0.894 | 95.5 | 0.896 | 95.5 | 0.898 | 95.5 | 0.900 | 95.7 |
| 0.900 | 95.5 | 0.902 | 95.5 | 0.904 | 95.5 | 0.906 | 95.5 | 0.908 | 95.5 | 0.910 | 95.7 |
| 0.910 | 95.5 | 0.912 | 95.5 | 0.914 | 95.5 | 0.916 | 95.5 | 0.918 | 95.5 | 0.920 | 95.7 |
| 0.920 | 95.5 | 0.922 | 95.5 | 0.924 | 95.5 | 0.926 | 95.5 | 0.928 | 95.5 | 0.930 | 95.7 |
| 0.930 | 95.5 | 0.932 | 95.5 | 0.934 | 95.5 | 0.936 | 95.5 | 0.938 | 95.5 | 0.940 | 95.7 |
| 0.940 | 95.5 | 0.942 | 95.5 | 0.944 | 95.5 | 0.946 | 95.5 | 0.948 | 95.5 | 0.950 | 95.7 |
| 0.950 | 95.5 | 0.952 | 95.5 | 0.954 | 95.5 | 0.956 | 95.5 | 0.958 | 95.5 | 0.960 | 95.7 |
| 0.960 | 95.5 | 0.962 | 95.5 | 0.964 | 95.5 | 0.966 | 95.5 | 0.968 | 95.5 | 0.970 | 95.7 |
| 0.970 | 95.5 | 0.972 | 95.5 | 0.974 | 95.5 | 0.976 | 95.5 | 0.978 | 95.5 | 0.980 | 95.7 |
| 0.980 | 95.5 | 0.982 | 95.5 | 0.984 | 95.5 | 0.986 | 95.5 | 0.988 | 95.5 | 0.990 | 95.7 |
| 0.990 | 95.5 | 0.992 | 95.5 | 0.994 | 95.5 | 0.996 | 95.5 | 0.998 | 95.5 | 1.000 | 95.7 |

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OF POOR QUALITY

ALPHA(S) = 0.112

42

$$\text{ALPHA}(8) = 0.110$$
43

三

FIGURE 1. EFFECT OF REAL-TIME SOLAR UV, VACUUM UV, PROTONS,

AND ELECTRONS ON THE REFLECTANCE OF SAPPHIRE IN SITU
IN SITU, AFTER 313 HOURS EXPOSURE

$$\text{ALPHA}(8) = 0.415$$

HEMISPHERICAL SPECTRAL REFLECTANCE VS. WAVELENGTH

| WAVELENGTH
(λ MBDA) | F (λ MBDA) | WAVELENGTH
(λ MBDA) | F (λ MBDA) | WAVELENGTH
(λ MBDA) | F (λ MBDA) | WAVELENGTH
(λ MBDA) | F (λ MBDA) | WAVELENGTH
(λ MBDA) | F (λ MBDA) |
|---------------------------------|---------------------|---------------------------------|---------------------|---------------------------------|---------------------|---------------------------------|---------------------|---------------------------------|---------------------|
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 |
| 0.250 | 19.7 | 0.252 | 19.6 | 0.254 | 19.7 | 0.256 | 19.4 | 0.258 | 19.4 |
| 0.260 | 19.3 | 0.262 | 19.3 | 0.264 | 19.2 | 0.266 | 19.1 | 0.268 | 19.1 |
| 0.270 | 18.7 | 0.272 | 18.6 | 0.274 | 18.6 | 0.276 | 18.2 | 0.278 | 18.2 |
| 0.280 | 17.5 | 0.282 | 17.3 | 0.284 | 16.9 | 0.286 | 16.8 | 0.288 | 16.4 |
| 0.290 | 16.0 | 0.292 | 15.6 | 0.294 | 15.2 | 0.296 | 14.6 | 0.298 | 14.2 |
| 0.300 | 13.6 | 0.302 | 13.2 | 0.304 | 12.8 | 0.306 | 12.5 | 0.308 | 12.6 |
| 0.310 | 12.8 | 0.312 | 13.6 | 0.314 | 14.2 | 0.316 | 16.2 | 0.318 | 18.6 |
| 0.320 | 21.9 | 0.322 | 24.0 | 0.324 | 33.8 | 0.326 | 41.0 | 0.328 | 47.2 |
| 0.330 | 53.3 | 0.332 | 57.4 | 0.334 | 60.3 | 0.336 | 62.2 | 0.338 | 63.6 |
| 0.340 | 65.2 | 0.342 | 64.1 | 0.344 | 67.0 | 0.346 | 67.3 | 0.348 | 68.5 |
| 0.350 | 68.5 | 0.352 | 64.9 | 0.354 | 69.2 | 0.356 | 69.5 | 0.358 | 70.0 |
| 0.360 | 70.2 | 0.362 | 71.1 | 0.370 | 71.8 | 0.375 | 72.0 | 0.380 | 73.9 |
| 0.385 | 75.0 | 0.390 | 75.9 | 0.395 | 76.9 | 0.400 | 77.8 | 0.405 | 78.8 |
| 0.410 | 79.9 | 0.415 | 80.4 | 0.420 | 81.7 | 0.425 | 82.1 | 0.430 | 82.9 |
| 0.435 | 83.6 | 0.440 | 84.2 | 0.445 | 84.2 | 0.450 | 85.2 | 0.455 | 85.7 |
| 0.460 | 86.1 | 0.465 | 86.3 | 0.470 | 86.5 | 0.475 | 86.6 | 0.480 | 87.1 |
| 0.485 | 87.3 | 0.490 | 87.5 | 0.495 | 87.8 | 0.500 | 88.0 | 0.505 | 88.4 |
| 0.510 | 88.5 | 0.515 | 88.7 | 0.520 | 88.8 | 0.525 | 89.1 | 0.530 | 89.6 |
| 0.535 | 89.7 | 0.540 | 90.4 | 0.545 | 90.4 | 0.550 | 90.3 | 0.555 | 90.4 |
| 0.560 | 90.6 | 0.565 | 91.0 | 0.570 | 91.0 | 0.575 | 91.5 | 0.580 | 91.2 |
| 0.585 | 92.1 | 0.590 | 91.9 | 0.595 | 92.0 | 0.600 | 92.5 | 0.605 | 92.2 |
| 0.610 | 92.3 | 0.615 | 92.3 | 0.620 | 92.3 | 0.625 | 92.6 | 0.630 | 92.4 |
| 0.635 | 92.1 | 0.640 | 92.5 | 0.645 | 92.1 | 0.650 | 92.3 | 0.655 | 92.4 |
| 0.660 | 92.6 | 0.665 | 92.3 | 0.670 | 92.5 | 0.675 | 92.6 | 0.680 | 92.5 |
| 0.685 | 92.4 | 0.690 | 92.4 | 0.695 | 92.7 | 0.700 | 92.5 | 0.720 | 93.0 |
| 0.740 | 93.1 | 0.760 | 93.1 | 0.780 | 93.5 | 0.800 | 93.3 | 0.820 | 93.4 |
| 0.840 | 94.4 | 0.860 | 94.2 | 0.880 | 94.5 | 0.900 | 94.0 | 0.920 | 94.1 |
| 0.940 | 94.0 | 0.960 | 94.2 | 0.980 | 94.5 | 1.000 | 94.2 | 1.020 | 94.5 |
| 1.040 | 94.1 | 1.060 | 94.4 | 1.080 | 94.5 | 1.100 | 94.8 | 1.120 | 94.6 |
| 1.140 | 94.7 | 1.160 | 94.6 | 1.180 | 94.8 | 1.200 | 94.6 | 1.220 | 94.8 |
| 1.240 | 94.8 | 1.260 | 95.0 | 1.280 | 94.8 | 1.300 | 95.2 | 1.320 | 95.0 |
| 1.340 | 94.9 | 1.360 | 94.9 | 1.380 | 94.8 | 1.400 | 95.2 | 1.420 | 95.1 |
| 1.440 | 95.1 | 1.460 | 95.1 | 1.480 | 95.2 | 1.500 | 95.1 | 1.520 | 95.2 |
| 1.540 | 95.0 | 1.560 | 95.0 | 1.580 | 95.2 | 1.600 | 95.1 | 1.620 | 95.2 |
| 1.640 | 95.3 | 1.660 | 95.3 | 1.680 | 95.3 | 1.700 | 95.2 | 1.720 | 95.2 |
| 1.740 | 95.3 | 1.760 | 95.5 | 1.780 | 95.3 | 1.800 | 95.5 | 1.820 | 95.5 |
| 1.840 | 95.6 | 1.860 | 95.7 | 1.880 | 95.6 | 1.900 | 95.8 | 1.920 | 95.7 |
| 1.940 | 95.9 | 1.960 | 95.8 | 1.980 | 95.9 | 2.000 | 96.0 | 2.020 | 95.9 |
| 2.040 | 95.9 | 2.060 | 95.8 | 2.080 | 95.6 | 2.100 | 95.6 | 2.120 | 95.8 |
| 2.140 | 95.6 | 2.160 | 95.6 | 2.180 | 95.6 | 2.200 | 95.6 | 2.220 | 95.6 |
| 2.240 | 95.8 | 2.260 | 96.0 | 2.280 | 95.9 | 2.300 | 95.8 | 2.320 | 95.9 |
| 2.340 | 95.1 | 2.360 | 96.3 | 2.380 | 96.2 | 2.400 | 96.2 | 2.420 | 96.4 |
| 2.440 | 95.8 | 2.460 | 96.5 | 2.480 | 96.3 | 2.500 | 96.5 | | |

1-8

FIGURE 9. EFFECT OF REAL-TIME SOLAR UV, VACUUM UV, PROTONS,

AND ELECTRON'S ON THE REFLECTANCE OF SAPPHIRE IN SITU
IN SITU, AFTER 503 HOURS EXPOSURE

ALPHA(S) = 0.118

| WAVELENGTH
(λ MPDA) | F(λ MPDA) | WAVELENGTH
(λ MPDA) | F(λ MPDA) | WAVELENGTH
(λ MPDA) | F(λ MPDA) | WAVELENGTH
(λ MPDA) | F(λ MPDA) | WAVELENGTH
(λ MPDA) | F(λ MPDA) |
|---------------------------------|--------------------|---------------------------------|--------------------|---------------------------------|--------------------|---------------------------------|--------------------|---------------------------------|--------------------|
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 |
| 0.250 | 19.3 | 0.252 | 19.0 | 0.254 | 19.2 | 0.256 | 19.2 | 0.258 | 19.1 |
| 0.260 | 19.1 | 0.262 | 19.0 | 0.264 | 18.9 | 0.266 | 18.7 | 0.268 | 18.6 |
| 0.270 | 18.0 | 0.272 | 18.3 | 0.274 | 18.1 | 0.276 | 17.9 | 0.278 | 17.7 |
| 0.280 | 17.5 | 0.282 | 17.3 | 0.284 | 17.0 | 0.286 | 16.8 | 0.288 | 16.3 |
| 0.290 | 15.9 | 0.292 | 15.8 | 0.294 | 15.1 | 0.296 | 14.7 | 0.298 | 14.2 |
| 0.300 | 14.0 | 0.302 | 13.6 | 0.304 | 12.6 | 0.306 | 12.5 | 0.308 | 12.6 |
| 0.310 | 12.9 | 0.312 | 13.5 | 0.314 | 14.6 | 0.316 | 15.9 | 0.318 | 18.3 |
| 0.320 | 22.0 | 0.322 | 26.7 | 0.324 | 33.1 | 0.326 | 40.0 | 0.328 | 46.0 |
| 0.330 | 51.5 | 0.332 | 55.2 | 0.334 | 58.4 | 0.336 | 59.9 | 0.338 | 61.9 |
| 0.340 | 62.9 | 0.342 | 64.0 | 0.344 | 65.2 | 0.346 | 65.2 | 0.348 | 66.2 |
| 0.350 | 66.2 | 0.352 | 67.7 | 0.354 | 67.6 | 0.356 | 67.6 | 0.358 | 68.0 |
| 0.360 | 68.6 | 0.365 | 69.8 | 0.370 | 70.6 | 0.375 | 71.4 | 0.380 | 72.7 |
| 0.385 | 75.6 | 0.390 | 74.7 | 0.395 | 75.8 | 0.400 | 76.5 | 0.405 | 77.8 |
| 0.410 | 78.6 | 0.415 | 79.5 | 0.420 | 80.3 | 0.425 | 80.8 | 0.430 | 82.2 |
| 0.435 | 82.3 | 0.440 | 83.3 | 0.445 | 83.7 | 0.450 | 84.6 | 0.455 | 84.9 |
| 0.460 | 85.4 | 0.465 | 85.3 | 0.470 | 85.9 | 0.475 | 86.1 | 0.480 | 86.5 |
| 0.485 | 86.9 | 0.490 | 86.8 | 0.495 | 87.4 | 0.500 | 87.3 | 0.505 | 88.2 |
| 0.510 | 89.1 | 0.515 | 88.4 | 0.520 | 88.5 | 0.525 | 88.9 | 0.530 | 89.3 |
| 0.535 | 89.1 | 0.540 | 89.8 | 0.545 | 90.1 | 0.550 | 90.1 | 0.555 | 90.1 |
| 0.560 | 90.5 | 0.565 | 90.8 | 0.570 | 91.1 | 0.575 | 91.3 | 0.580 | 91.5 |
| 0.585 | 92.0 | 0.590 | 92.3 | 0.595 | 91.7 | 0.600 | 92.4 | 0.605 | 91.8 |
| 0.610 | 92.3 | 0.615 | 91.9 | 0.620 | 92.4 | 0.625 | 92.3 | 0.630 | 92.1 |
| 0.635 | 92.5 | 0.640 | 92.3 | 0.645 | 92.1 | 0.650 | 92.1 | 0.655 | 92.6 |
| 0.660 | 92.3 | 0.665 | 91.9 | 0.670 | 92.2 | 0.675 | 92.4 | 0.680 | 92.5 |
| 0.685 | 92.5 | 0.690 | 92.3 | 0.695 | 92.4 | 0.700 | 92.5 | 0.720 | 92.7 |
| 0.720 | 92.7 | 0.760 | 92.3 | 0.780 | 93.0 | 0.800 | 93.2 | 0.820 | 93.3 |
| 0.840 | 93.5 | 0.860 | 93.6 | 0.880 | 93.8 | 0.900 | 94.0 | 0.920 | 93.8 |
| 0.940 | 93.7 | 0.960 | 94.3 | 0.980 | 94.3 | 1.000 | 94.2 | 1.020 | 94.4 |
| 1.040 | 94.1 | 1.060 | 94.4 | 1.080 | 94.4 | 1.100 | 94.5 | 1.120 | 94.8 |
| 1.140 | 94.4 | 1.160 | 94.6 | 1.180 | 94.5 | 1.200 | 94.6 | 1.220 | 94.8 |
| 1.240 | 94.8 | 1.260 | 94.8 | 1.280 | 94.8 | 1.300 | 94.8 | 1.320 | 94.8 |
| 1.340 | 94.8 | 1.360 | 94.9 | 1.380 | 94.7 | 1.400 | 95.1 | 1.420 | 94.9 |
| 1.440 | 94.9 | 1.460 | 94.9 | 1.480 | 94.9 | 1.500 | 95.1 | 1.520 | 95.0 |
| 1.540 | 95.0 | 1.560 | 95.0 | 1.580 | 95.2 | 1.600 | 95.0 | 1.620 | 95.2 |
| 1.640 | 95.2 | 1.660 | 95.2 | 1.680 | 95.2 | 1.700 | 95.0 | 1.720 | 95.1 |
| 1.740 | 95.3 | 1.760 | 95.3 | 1.780 | 95.2 | 1.800 | 95.2 | 1.820 | 95.1 |
| 1.840 | 95.2 | 1.860 | 95.4 | 1.880 | 95.4 | 1.900 | 95.5 | 1.920 | 95.5 |
| 1.940 | 95.4 | 1.960 | 95.5 | 1.980 | 95.7 | 2.000 | 95.7 | 2.020 | 95.6 |
| 2.040 | 95.6 | 2.060 | 95.6 | 2.080 | 95.6 | 2.100 | 95.6 | 2.120 | 95.6 |
| 2.140 | 95.4 | 2.160 | 95.4 | 2.180 | 95.3 | 2.200 | 95.5 | 2.220 | 95.2 |
| 2.240 | 95.4 | 2.260 | 95.7 | 2.280 | 95.7 | 2.300 | 95.8 | 2.320 | 95.8 |
| 2.340 | 95.4 | 2.360 | 95.8 | 2.380 | 95.8 | 2.400 | 95.9 | 2.420 | 95.9 |
| 2.440 | 95.7 | 2.460 | 96.2 | 2.480 | 96.0 | 2.500 | 96.0 | | |

ORIGINAL PAGE IS
OF POOR QUALITY

FIGURE . EFFECT OF SOLAR UV, VACUUM UV, PROTONS, AND ELECTRONS ON

IN VACUUM, BEFORE EXPOSURE

THE REFLECTION OF 1971 LOW EXPANSION GLASS IN SITU

$$\text{ALPHA}(8) = 0.085$$

| HEMISPHERICAL SPECTRAL REFLECTANCE | | | | VS. WAVELENGTH | | | | ALPHA(2) = 0.085 | | | |
|------------------------------------|-----------|-------------------------|-----------|-------------------------|-----------|-------------------------|-----------|-------------------------|-----------|-------------------------|-----------|
| WAVELENGTH
(LAMBDAA) | F(LAMBDA) | WAVELENGTH
(LAMBDAA) | F(LAMBDA) | WAVELENGTH
(LAMBDAA) | F(LAMBDA) | WAVELENGTH
(LAMBDAA) | F(LAMBDA) | WAVELENGTH
(LAMBDAA) | F(LAMBDA) | WAVELENGTH
(LAMBDAA) | F(LAMBDA) |
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 | 0.240 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 | 0.250 | 0.0 |
| 0.250 | 6.1 | 0.252 | 6.2 | 0.254 | 6.1 | 0.256 | 6.1 | 0.258 | 6.1 | 0.260 | 5.9 |
| 0.260 | 5.9 | 0.262 | 5.9 | 0.264 | 6.0 | 0.266 | 5.8 | 0.268 | 5.8 | 0.270 | 5.7 |
| 0.270 | 5.8 | 0.272 | 5.7 | 0.274 | 5.7 | 0.276 | 5.6 | 0.278 | 5.6 | 0.280 | 5.7 |
| 0.280 | 5.9 | 0.282 | 6.2 | 0.284 | 7.0 | 0.286 | 7.8 | 0.288 | 8.6 | 0.290 | 10.7 |
| 0.290 | 9.5 | 0.292 | 10.0 | 0.294 | 10.5 | 0.296 | 10.5 | 0.298 | 10.7 | 0.300 | 10.7 |
| 0.300 | 10.5 | 0.302 | 5.8 | 0.304 | 9.2 | 0.306 | 8.9 | 0.308 | 8.6 | 0.310 | 8.6 |
| 0.310 | 8.3 | 0.312 | 8.5 | 0.314 | 9.5 | 0.316 | 10.9 | 0.318 | 13.3 | 0.320 | 13.3 |
| 0.320 | 16.6 | 0.322 | 22.5 | 0.324 | 30.1 | 0.326 | 38.9 | 0.328 | 48.2 | 0.330 | 48.2 |
| 0.330 | 55.7 | 0.332 | 62.0 | 0.334 | 66.4 | 0.336 | 69.2 | 0.338 | 72.4 | 0.340 | 72.4 |
| 0.340 | 74.2 | 0.342 | 75.9 | 0.344 | 77.3 | 0.346 | 79.3 | 0.348 | 79.7 | 0.350 | 79.7 |
| 0.350 | 80.9 | 0.352 | 81.7 | 0.354 | 81.8 | 0.356 | 83.0 | 0.358 | 84.8 | 0.360 | 84.8 |
| 0.360 | 84.7 | 0.362 | 86.1 | 0.364 | 87.2 | 0.366 | 88.3 | 0.368 | 89.0 | 0.370 | 89.0 |
| 0.385 | 90.3 | 0.390 | 90.9 | 0.395 | 91.4 | 0.400 | 91.7 | 0.405 | 91.8 | 0.410 | 91.8 |
| 0.410 | 92.3 | 0.415 | 92.7 | 0.420 | 93.0 | 0.425 | 93.2 | 0.430 | 93.8 | 0.435 | 93.8 |
| 0.435 | 93.9 | 0.440 | 94.2 | 0.445 | 94.3 | 0.450 | 94.1 | 0.455 | 94.1 | 0.460 | 94.1 |
| 0.460 | 94.3 | 0.465 | 94.3 | 0.470 | 94.3 | 0.475 | 93.9 | 0.480 | 94.4 | 0.485 | 94.4 |
| 0.485 | 94.0 | 0.490 | 94.5 | 0.495 | 94.3 | 0.500 | 94.2 | 0.505 | 94.6 | 0.510 | 94.6 |
| 0.510 | 94.3 | 0.515 | 94.5 | 0.520 | 94.5 | 0.525 | 94.5 | 0.530 | 94.8 | 0.535 | 94.8 |
| 0.535 | 95.0 | 0.540 | 95.1 | 0.545 | 94.9 | 0.550 | 94.6 | 0.555 | 95.1 | 0.560 | 95.1 |
| 0.560 | 95.0 | 0.565 | 95.5 | 0.570 | 95.5 | 0.575 | 95.4 | 0.580 | 95.5 | 0.585 | 95.5 |
| 0.585 | 95.9 | 0.590 | 95.8 | 0.595 | 95.4 | 0.600 | 95.7 | 0.605 | 95.5 | 0.610 | 95.5 |
| 0.610 | 95.6 | 0.615 | 95.6 | 0.620 | 95.6 | 0.625 | 95.7 | 0.630 | 95.7 | 0.635 | 95.7 |
| 0.635 | 95.8 | 0.640 | 95.5 | 0.645 | 95.8 | 0.650 | 95.6 | 0.655 | 95.4 | 0.660 | 95.4 |
| 0.660 | 95.5 | 0.665 | 95.4 | 0.670 | 95.4 | 0.675 | 95.6 | 0.680 | 95.5 | 0.685 | 95.5 |
| 0.685 | 95.5 | 0.690 | 95.4 | 0.695 | 95.4 | 0.700 | 95.4 | 0.705 | 95.1 | 0.710 | 95.1 |
| 0.710 | 95.2 | 0.715 | 95.1 | 0.720 | 95.1 | 0.725 | 95.2 | 0.730 | 95.0 | 0.735 | 95.0 |
| 0.735 | 95.0 | 0.740 | 95.4 | 0.745 | 95.5 | 0.750 | 95.5 | 0.755 | 95.5 | 0.760 | 95.5 |
| 0.760 | 95.3 | 0.765 | 95.7 | 0.770 | 95.7 | 0.775 | 95.6 | 0.780 | 95.7 | 0.785 | 95.7 |
| 0.785 | 95.3 | 0.790 | 95.7 | 0.795 | 95.7 | 0.800 | 95.8 | 0.805 | 95.7 | 0.810 | 95.7 |
| 0.810 | 95.3 | 0.815 | 95.7 | 0.820 | 95.7 | 0.825 | 95.7 | 0.830 | 95.7 | 0.835 | 95.7 |
| 0.835 | 95.3 | 0.840 | 95.8 | 0.845 | 95.5 | 0.850 | 95.5 | 0.855 | 95.5 | 0.86 | |

FIGURE 1. EFFECT OF SOLAR UV, VACUUM UV, PROTONS, AND ELECTRONS ON

IN SITU, AFTER 50 HOURS EXPOSURE

THE REFLECTANCE OF 7971 LOW EXPANSION GLASS IN SITU

ALPHA(S) = 0.092

| HEMISPHERICAL SPECTRAL REFLECTANCE | | | | VS. WAVELENGTH | | | | ALPHA(9) = 0.092 | | | |
|------------------------------------|------------|-------------------------|------------|-------------------------|------------|-------------------------|------------|-------------------------|------------|-------------------------|------------|
| WAVELENGTH
(LAMBDAA) | F(LAMBDAA) | WAVELENGTH
(LAMBDAA) | F(LAMBDAA) | WAVELENGTH
(LAMBDAA) | F(LAMBDAA) | WAVELENGTH
(LAMBDAA) | F(LAMBDAA) | WAVELENGTH
(LAMBDAA) | F(LAMBDAA) | WAVELENGTH
(LAMBDAA) | F(LAMBDAA) |
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 | 0.240 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 | 0.250 | 0.0 |
| 0.250 | 6.0 | 0.252 | 6.1 | 0.254 | 6.1 | 0.256 | 6.1 | 0.258 | 6.1 | 0.260 | 6.0 |
| 0.260 | 6.1 | 0.262 | 5.9 | 0.264 | 5.8 | 0.266 | 5.8 | 0.268 | 5.8 | 0.270 | 5.7 |
| 0.270 | 5.7 | 0.272 | 5.8 | 0.274 | 5.6 | 0.276 | 5.6 | 0.278 | 5.6 | 0.280 | 5.0 |
| 0.280 | 6.0 | 0.282 | 6.4 | 0.284 | 7.0 | 0.286 | 7.7 | 0.288 | 8.6 | 0.290 | 10.7 |
| 0.290 | 9.3 | 0.292 | 9.7 | 0.294 | 10.2 | 0.296 | 10.6 | 0.298 | 10.7 | 0.300 | 10.7 |
| 0.300 | 10.3 | 0.302 | 9.9 | 0.304 | 9.2 | 0.306 | 8.8 | 0.308 | 8.3 | 0.310 | 8.3 |
| 0.310 | 8.0 | 0.312 | 8.4 | 0.314 | 9.2 | 0.316 | 10.9 | 0.318 | 13.1 | 0.320 | 13.1 |
| 0.320 | 16.3 | 0.322 | 22.0 | 0.324 | 29.6 | 0.326 | 38.4 | 0.328 | 47.2 | 0.330 | 47.2 |
| 0.330 | 54.8 | 0.332 | 61.3 | 0.334 | 65.5 | 0.336 | 69.0 | 0.338 | 71.4 | 0.340 | 71.4 |
| 0.340 | 73.6 | 0.342 | 74.9 | 0.344 | 76.6 | 0.346 | 77.5 | 0.348 | 78.8 | 0.350 | 78.8 |
| 0.350 | 79.5 | 0.352 | 80.7 | 0.354 | 81.1 | 0.356 | 82.3 | 0.358 | 82.9 | 0.360 | 82.9 |
| 0.360 | 83.0 | 0.362 | 84.4 | 0.364 | 85.4 | 0.366 | 86.1 | 0.368 | 87.4 | 0.370 | 87.4 |
| 0.370 | 86.3 | 0.372 | 88.6 | 0.374 | 89.0 | 0.376 | 89.5 | 0.378 | 89.5 | 0.380 | 89.5 |
| 0.380 | 90.5 | 0.382 | 90.7 | 0.384 | 91.2 | 0.386 | 91.6 | 0.388 | 92.0 | 0.390 | 92.0 |
| 0.390 | 92.1 | 0.392 | 92.3 | 0.394 | 92.2 | 0.396 | 92.4 | 0.398 | 92.8 | 0.400 | 92.8 |
| 0.400 | 92.7 | 0.402 | 92.7 | 0.404 | 92.1 | 0.406 | 92.2 | 0.408 | 93.0 | 0.410 | 93.0 |
| 0.410 | 92.6 | 0.412 | 92.8 | 0.414 | 93.0 | 0.416 | 93.0 | 0.418 | 93.3 | 0.420 | 93.3 |
| 0.420 | 93.1 | 0.422 | 93.2 | 0.424 | 93.7 | 0.426 | 93.8 | 0.428 | 94.1 | 0.430 | 94.1 |
| 0.430 | 94.0 | 0.432 | 94.7 | 0.434 | 94.6 | 0.436 | 94.9 | 0.438 | 94.9 | 0.440 | 94.9 |
| 0.440 | 94.7 | 0.442 | 94.4 | 0.444 | 95.0 | 0.446 | 95.0 | 0.448 | 95.4 | 0.450 | 95.4 |
| 0.450 | 94.8 | 0.452 | 94.5 | 0.454 | 94.3 | 0.456 | 94.7 | 0.458 | 94.8 | 0.460 | 94.8 |
| 0.460 | 94.7 | 0.462 | 94.7 | 0.464 | 95.0 | 0.466 | 95.2 | 0.468 | 95.4 | 0.470 | 95.4 |
| 0.470 | 94.9 | 0.472 | 95.1 | 0.474 | 95.6 | 0.476 | 95.9 | 0.478 | 96.0 | 0.480 | 96.0 |
| 0.480 | 95.2 | 0.482 | 95.7 | 0.484 | 95.7 | 0.486 | 95.9 | 0.488 | 96.1 | 0.490 | 96.1 |
| 0.490 | 95.5 | 0.492 | 95.6 | 0.494 | 95.6 | 0.496 | 95.6 | 0.498 | 95.6 | 0.500 | 95.6 |
| 0.500 | 95.8 | 0.502 | 95.6 | 0.504 | 95.6 | 0.506 | 95.6 | 0.508 | 95.6 | 0.510 | 95.6 |
| 0.510 | 96.1 | 0.512 | 96.0 | 0.514 | 96.0 | 0.516 | 96.0 | 0.518 | 96.0 | 0.520 | 96.0 |
| 0.520 | 96.2 | 0.522 | 96.2 | 0.524 | 96.2 | 0.526 | 96.2 | 0.528 | 96.2 | 0.530 | 96.2 |
| 0.530 | 96.3 | 0.532 | 96.3 | 0.534 | 96.3 | 0.536 | 96.3 | 0.538 | 96.3 | 0.540 | 96.3 |
| 0.540 | 96.3 | 0.542 | 96.3 | 0.544 | 96.3 | 0.546 | 96.3 | 0.548 | 96.3 | 0.550 | 96.3 |
| 0.550 | 96.3 | 0.552 | 96.3 | 0.554 | 96.3 | 0.556 | 96.3 | 0.558 | 96.3 | 0.560 | 96.3 |
| 0.560 | 96.3 | 0.562 | 96.3 | 0.564 | 96.3 | 0.566 | 96.3 | 0.568 | 96.3 | 0.570 | 96.3 |
| 0.570 | 96.3 | 0.572 | 96.3 | 0.574 | 96.3 | 0.576 | 96.3 | 0.578 | 96.3 | 0.580 | 96.3 |
| 0.580 | 96.3 | 0.582 | 96.3 | 0.584 | 96.3 | 0.586 | 96.3 | 0.588 | 96.3 | 0.590 | 96.3 |
| 0.590 | 96.3 | 0.592 | 96.3 | 0.594 | 96.3 | 0.596 | 96.3 | 0.598 | 96.3 | 0.600 | 96.3 |
| 0.600 | 96.3 | 0.602 | 96.3 | 0.604 | 96.3 | 0.606 | 96.3 | 0.608 | 96.3 | 0.610 | 96.3 |
| 0.610 | 96.3 | 0.612 | 96.3 | 0.614 | 96.3 | 0.616 | 96.3 | 0.618 | 96.3 | 0.620 | 96.3 |
| 0.620 | 96.3 | 0.622 | 96.3 | 0.624 | 96.3 | 0.626 | 96.3 | 0.628 | 96.3 | 0.630 | 96.3 |
| 0.630 | 96.3 | 0.632 | 96.3 | 0.634 | 96.3 | 0.636 | 96.3 | 0.638 | 96.3 | 0.640 | 96.3 |
| 0.640 | 96.3 | 0.642 | 96.3 | 0.644 | 96.3 | 0.646 | 96.3 | 0.648 | 96.3 | 0.650 | 96.3 |
| 0.650 | 96.3 | 0.652 | 96.3 | 0.654 | 96.3 | 0.656 | 96.3 | 0.658 | 96.3 | 0.660 | 96.3 |
| 0.660 | 96.3 | 0.662 | 96.3 | 0.664 | 96.3 | 0.666 | 96.3 | 0.668 | 96.3 | 0.670 | 96.3 |
| 0.670 | 96.3 | 0.672 | 96.3 | 0.674 | 96.3 | 0.676 | 96.3 | 0.678 | 96.3 | 0.680 | 96.3 |
| 0.680 | 96.3 | 0.682 | 96.3 | 0.684 | 96.3 | 0.686 | 96.3 | 0.688 | 96.3 | 0.690 | 96.3 |
| 0.690 | 96.3 | 0.692 | 96.3 | 0.694 | 96.3 | 0.696 | 96.3 | 0.698 | 96.3 | 0.700 | 96.3 |
| 0.700 | 96.3 | 0.702 | 96.3 | 0.704 | 96.3 | 0.706 | 96.3 | 0.708 | 96.3 | 0.710 | 96.3 |
| 0.710 | 96.3 | 0.712 | 96.3 | 0.714 | 96.3 | 0.716 | 96.3 | 0.718 | 96.3 | 0.720 | 96.3 |
| 0.720 | 96.3 | 0.722 | 96.3 | 0.724 | 96.3 | 0.726 | 96.3 | 0.728 | 96.3 | 0.730 | 96.3 |
| 0.730 | 96.3 | 0.732 | 96.3 | 0.734 | 96.3 | 0.736 | 96.3 | 0.738 | 96.3 | 0.740 | 96.3 |
| 0.740 | 96.3 | 0.742 | 96.3 | 0.744 | 96.3 | 0.746 | 96.3 | 0.748 | 96.3 | 0.750 | 96.3 |
| 0.750 | 96.3 | 0.752 | 96.3 | 0.754 | 96.3 | 0.756 | 96.3 | 0.758 | 96.3 | 0.760 | 96.3 |
| 0.760 | 96.3 | 0.762 | 96.3 | 0.764 | 96.3 | 0.766 | 96.3 | 0.768 | 96.3 | 0.770 | 96.3 |
| 0.770 | 96.3 | 0.772 | 96.3 | 0.774 | 96.3 | 0.776 | 96.3 | 0.778 | 96.3 | 0.780 | 96.3 |
| 0.780 | 96.3 | 0.782 | 96.3 | 0.784 | 96.3 | 0.786 | 96.3 | 0.788 | 96.3 | 0.790 | 96.3 |
| 0.790 | 96.3 | 0.792 | 96.3 | 0.794 | 96.3 | 0.796 | 96.3 | 0.798 | 96.3 | 0.800 | 96.3 |
| 0.800 | 96.3 | 0.802 | 96.3 | 0.804 | 96.3 | 0.806 | 96.3 | 0.808 | 96.3 | 0.810 | 96.3 |
| 0.810 | 96.3 | 0.812 | 96.3 | 0.814 | 96.3 | 0.816 | 96.3 | 0.818 | 96.3 | 0.820 | 96.3 |
| 0.820 | 96.3 | 0.822 | 96.3 | 0.824 | 96.3 | 0.826 | 96.3 | 0.828 | 96.3 | 0.830 | 96.3 |
| 0.830 | 96.3 | 0.832 | 96.3 | 0.834 | 96.3 | 0.836 | 96.3 | 0.838 | 96.3 | 0.840 | 96.3 |
| 0.840 | 96.3 | 0.842 | 96.3 | 0.844 | 96.3 | 0.846 | 96.3 | 0.848 | 96.3 | 0.850 | 96.3 |
| 0.850 | 96.3 | 0.852 | 96.3 | 0.854 | 96.3 | 0.856 | 96.3 | 0.858 | 96.3 | 0.860 | 96.3 |
| 0.860 | 96.3 | 0.862 | 96.3 | 0.864 | 96.3 | 0.866 | 96.3 | 0.868 | 96.3 | 0.870 | 96.3 |
| 0.870 | 96.3 | 0.872 | 96.3 | 0.874 | 96.3 | 0.876 | 96.3 | 0.878 | 96.3 | 0.880 | 96.3 |
| 0.880 | 96.3 | 0.882 | 96.3 | 0.884 | 96.3 | 0.886 | 96.3 | 0.888 | 96.3 | 0.890 | 96.3 |
| 0.890 | 96.3 | 0.892 | 96.3 | 0.894 | 96.3 | 0.896 | 96.3 | 0.898 | 96.3 | 0.900 | 96.3 |
| 0.900 | 96.3 | 0.902 | 96.3 | 0.904 | 96.3 | 0.906 | 96.3 | 0.908 | 96.3 | 0.910 | 96.3 |
| 0.910 | 96.3 | 0.912 | 96.3 | 0.914 | 96.3 | 0.916 | 96.3 | 0.918 | 96.3 | 0.920 | 96.3 |
| 0.920 | 96.3 | 0.922 | 96.3 | 0.924 | 96.3 | 0.926 | 96.3 | 0.928 | 96.3 | 0.930 | 96.3 |
| 0.930 | 96.3 | 0.932 | 96.3 | 0.934 | 96.3 | 0.936 | 96.3 | 0.938 | 96.3 | 0.940 | 96.3 |
| 0.940 | 96.3 | 0.942 | 96.3 | 0.944 | 96.3 | 0.946 | 96.3 | 0.948 | 96.3 | 0.950 | 96.3 |
| 0.950 | 96.3 | 0.952 | 96.3 | 0.954 | 96.3 | 0.956 | 96.3 | 0.958 | 96.3 | 0.960 | 96.3 |
| 0.960 | 96.3 | 0.962 | 96.3 | 0.964 | 96.3 | 0.966 | 96.3 | 0.968 | 96.3 | 0.970 | 96.3 |
| 0.970 | 96.3 | 0.972 | 96.3 | 0.974 | 96.3 | 0.976 | 96.3 | 0.978 | 96.3 | 0.980 | 96.3 |
| 0.980 | 96.3 | 0.982 | 96.3 | 0.984 | 96.3 | 0.986 | 96.3 | 0.988 | 96.3 | 0.990 | 96.3 |
| 0.990 | 96.3 | 0.992 | 96.3 | 0.994 | 96.3 | 0.996 | 96.3 | 0.998 | 96.3 | 1.000 | 96.3 |
| 1.000 | 96.3 | 1.002 | 96.3 | 1.004 | 96.3 | 1.006 | 96.3 | 1.008 | 96.3 | 1.010 | 96.3 |
| 1.010 | 96.3 | 1.012 | 96.3 | 1.014 | 96.3 | 1.016 | 96.3 | 1.018 | 96.3 | 1.020 | 96.3 |
| 1.020 | 96.3 | 1.022 | 96.3 | 1.024 | 96.3 | 1.026 | 96.3 | 1.028 | 96.3 | 1.030 | 96.3 |
| 1.030 | 96.3 | 1.032 | 96.3 | 1.034 | 96.3 | 1.036 | 96.3 | 1.038 | 96.3 | 1.040 | 96.3 |
| 1.040 | 96.3 | 1.042 | 96.3 | 1.044 | 96.3 | 1.046 | 96.3 | 1.048 | 96.3 | 1.050 | 96.3 |
| 1.050 | 96.3 | 1.052 | 96.3 | 1.054 | 96.3 | 1.056 | 96.3 | 1.058 | 96.3 | 1.060 | 96.3 |
| 1.060 | 96.3 | 1.062 | 96.3 | 1.064 | 96.3 | 1.066 | 96.3 | 1.068 | 96.3 | 1.070 | 96.3 |
| 1.070 | 96.3 | 1.072 | 96.3 | 1.074 | 96.3 | 1.076 | 96.3 | 1.078 | 96.3 | 1.080 | 96.3 |
| 1.080 | 96.3 | 1.082 | 96.3 | 1.084 | 96.3 | 1.086 | 96.3 | 1.088 | 96.3 | 1.090 | 96.3 |
| 1.090 | 96.3 | 1.092 | 96.3 | 1.094 | 96.3 | 1.096 | 96.3 | 1.098 | 96.3 | 1.100 | 96.3 |
| 1.100 | 96.3 | 1.102 | 96.3 | 1.104 | 96.3 | 1.106 | 96.3 | 1.108 | 96.3 | 1.110 | 96.3 |
| 1.110 | 96.3 | 1.112 | 96.3 | 1.114 | 96.3 | 1.116 | 96.3 | 1.118 | 96.3 | 1.120 | 96.3 |
| 1.120 | 96.3 | 1.122 | 96.3 | 1.124 | 96.3 | 1.126 | 96.3 | 1.128 | 96.3 | 1.130 | 96.3 |
| 1.130 | 96.3 | 1.132 | 96.3 | 1.134 | 96.3 | 1.136 | 96.3 | 1.138 | 96.3 | 1.140 | 96.3 |
| 1.140 | 96.3 | 1.142 | 96.3 | 1.144 | 96.3 | 1.146 | 96.3 | 1.148 | 96.3 | 1.150 | 96.3 |
| 1.150 | 96.3 | 1.152 | 96.3 | 1.154 | 96.3 | 1.156 | 96.3 | 1.158 | 96.3 | 1.160 | 96.3 |
| 1.160 | 96.3 | 1.162 | 96.3 | 1.164 | 96.3 | 1.166 | 96.3 | 1.168 | 96.3 | 1.170 | 96.3 |
| 1.170 | 96.3 | 1.172 | 96.3 | 1.174 | 96.3 | 1.176 | 96.3 | 1.178 | 96.3 | 1.180 | 96.3 |
| 1.180 | 96.3 | 1.182 | 96.3 | 1.184 | 96.3 | 1.186 | 96.3 | 1.188 | 96.3 | 1.190 | 96.3 |
| 1.190 | 96.3 | 1.192 | 96.3 | 1.194 | 96.3 | 1.196 | 96.3 | 1.198 | 96.3 | 1.200 | 96.3 |
| 1.200 | 96.3 | 1.202 | 96.3 | 1.204 | 96.3 | 1.206 | 96.3 | 1.208 | 96.3 | 1.210 | 96.3 |
| 1.210 | 96.3 | 1.212 | 96.3 | 1.214 | 96.3 | 1.216 | 96.3 | 1.218 | 96.3 | 1.220 | 96.3 |
| 1.220 | 96.3 | 1.222 | 96.3 | 1.224 | 96.3 | 1.226 | 96.3 | 1.228 | 96.3 | 1.230 | 96.3 |
| 1.230 | 96.3 | 1.232 | 96.3 | 1.234 | 96.3 | 1.236 | 96.3 | 1.238 | 96.3 | 1.240 | 96.3 |
| 1.240 | 96.3 | 1.242 | 96.3 | 1.244 | 96.3 | 1.246 | 96.3 | 1.248 | 96.3 | 1.250 | 96.3 |
| 1.250 | 96.3 | 1.252 | 96.3 | 1.254 | 96.3 | 1.256 | 96.3 | 1.258 | 96.3 | 1.260 | 96.3 |
| 1.260 | 96.3 | 1.262 | 96.3 | 1.264 | 96.3 | 1.266 | 96.3 | | | | |

| HEMISPHERICAL SPECTRAL REFLECTANCE | | | VS. WAVELENGTH | | | ALPHA(S) = 0.098 | | | |
|------------------------------------|-----------|------------------------|----------------|------------------------|-----------|------------------------|-----------|------------------------|-----------|
| WAVELENGTH
(LAMBDA) | F(LAMBDA) | WAVELENGTH
(LAMBDA) | F(LAMBDA) | WAVELENGTH
(LAMBDA) | F(LAMBDA) | WAVELENGTH
(LAMBDA) | F(LAMBDA) | WAVELENGTH
(LAMBDA) | F(LAMBDA) |
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 |
| 0.250 | 6.5 | 0.252 | 6.7 | 0.254 | 6.8 | 0.256 | 6.7 | 0.258 | 6.6 |
| 0.260 | 6.6 | 0.262 | 6.5 | 0.264 | 6.5 | 0.266 | 6.3 | 0.268 | 6.3 |
| 0.270 | 6.3 | 0.272 | 6.3 | 0.274 | 6.2 | 0.276 | 6.1 | 0.278 | 6.3 |
| 0.280 | 6.6 | 0.282 | 7.0 | 0.284 | 7.7 | 0.286 | 8.3 | 0.288 | 9.2 |
| 0.290 | 9.7 | 0.292 | 10.4 | 0.294 | 10.8 | 0.296 | 11.0 | 0.298 | 10.8 |
| 0.300 | 10.7 | 0.302 | 10.2 | 0.304 | 9.7 | 0.306 | 9.2 | 0.308 | 8.8 |
| 0.310 | 8.8 | 0.312 | 8.9 | 0.314 | 9.9 | 0.316 | 11.5 | 0.318 | 13.6 |
| 0.320 | 16.9 | 0.322 | 22.6 | 0.324 | 29.5 | 0.326 | 38.3 | 0.328 | 47.4 |
| 0.330 | 55.1 | 0.332 | 60.0 | 0.334 | 64.8 | 0.336 | 67.3 | 0.338 | 70.2 |
| 0.340 | 72.5 | 0.342 | 73.6 | 0.344 | 75.1 | 0.346 | 76.6 | 0.348 | 77.4 |
| 0.350 | 78.1 | 0.352 | 78.8 | 0.354 | 79.3 | 0.356 | 80.5 | 0.358 | 81.7 |
| 0.360 | 81.8 | 0.362 | 83.1 | 0.364 | 84.3 | 0.366 | 85.2 | 0.368 | 86.4 |
| 0.370 | 87.0 | 0.372 | 87.6 | 0.374 | 88.6 | 0.376 | 89.6 | 0.378 | 89.0 |
| 0.380 | 89.7 | 0.382 | 90.2 | 0.384 | 90.4 | 0.386 | 90.6 | 0.388 | 90.8 |
| 0.390 | 90.8 | 0.392 | 91.4 | 0.394 | 91.1 | 0.396 | 91.5 | 0.398 | 92.0 |
| 0.400 | 92.1 | 0.402 | 92.1 | 0.404 | 92.2 | 0.406 | 91.9 | 0.408 | 92.4 |
| 0.410 | 92.3 | 0.412 | 92.3 | 0.414 | 92.4 | 0.416 | 92.3 | 0.418 | 92.5 |
| 0.420 | 92.5 | 0.422 | 92.7 | 0.424 | 92.6 | 0.426 | 92.9 | 0.428 | 93.1 |
| 0.430 | 93.0 | 0.432 | 93.1 | 0.434 | 93.6 | 0.436 | 93.7 | 0.438 | 93.7 |
| 0.440 | 93.9 | 0.442 | 94.3 | 0.444 | 94.0 | 0.446 | 94.1 | 0.448 | 94.2 |
| 0.450 | 94.7 | 0.452 | 94.7 | 0.454 | 94.7 | 0.456 | 95.0 | 0.458 | 94.5 |
| 0.460 | 94.9 | 0.462 | 94.8 | 0.464 | 94.7 | 0.466 | 95.0 | 0.468 | 94.7 |
| 0.470 | 94.7 | 0.472 | 94.8 | 0.474 | 94.4 | 0.476 | 94.4 | 0.478 | 94.4 |
| 0.480 | 94.5 | 0.482 | 94.4 | 0.484 | 94.4 | 0.486 | 94.6 | 0.488 | 94.5 |
| 0.490 | 94.5 | 0.492 | 94.3 | 0.494 | 94.6 | 0.496 | 94.6 | 0.498 | 94.3 |
| 0.500 | 94.7 | 0.502 | 94.4 | 0.504 | 95.2 | 0.506 | 95.2 | 0.508 | 95.2 |
| 0.510 | 95.0 | 0.512 | 95.4 | 0.514 | 95.6 | 0.516 | 95.3 | 0.518 | 95.5 |
| 0.520 | 95.3 | 0.522 | 95.5 | 0.524 | 95.6 | 0.526 | 95.7 | 0.528 | 95.5 |
| 0.530 | 95.5 | 0.532 | 95.6 | 0.534 | 95.6 | 0.536 | 95.6 | 0.538 | 95.7 |
| 0.540 | 95.6 | 0.542 | 95.7 | 0.544 | 95.6 | 0.546 | 95.5 | 0.548 | 94.7 |
| 0.550 | 95.8 | 0.552 | 95.8 | 0.554 | 95.8 | 0.556 | 95.3 | 0.558 | 95.7 |
| 0.560 | 96.0 | 0.562 | 96.2 | 0.564 | 96.1 | 0.566 | 96.1 | 0.568 | 96.1 |
| 0.570 | 96.3 | 0.572 | 96.1 | 0.574 | 96.0 | 0.576 | 96.1 | 0.578 | 96.1 |
| 0.580 | 96.0 | 0.582 | 96.2 | 0.584 | 96.1 | 0.586 | 96.0 | 0.588 | 96.0 |
| 0.590 | 96.4 | 0.592 | 96.3 | 0.594 | 96.3 | 0.596 | 96.3 | 0.598 | 96.2 |
| 0.600 | 96.6 | 0.602 | 96.3 | 0.604 | 96.2 | 0.606 | 96.0 | 0.608 | 96.2 |
| 0.610 | 96.4 | 0.612 | 96.4 | 0.614 | 96.3 | 0.616 | 96.0 | 0.618 | 96.2 |
| 0.620 | 96.6 | 0.622 | 96.6 | 0.624 | 96.5 | 0.626 | 96.0 | 0.628 | 96.2 |
| 0.630 | 96.8 | 0.632 | 96.7 | 0.634 | 96.7 | 0.636 | 96.0 | 0.638 | 96.2 |
| 0.640 | 97.0 | 0.642 | 97.0 | 0.644 | 97.0 | 0.646 | 96.0 | 0.648 | 96.2 |
| 0.650 | 97.2 | 0.652 | 97.2 | 0.654 | 97.2 | 0.656 | 96.0 | 0.658 | 96.2 |
| 0.660 | 97.4 | 0.662 | 97.4 | 0.664 | 97.4 | 0.666 | 96.0 | 0.668 | 96.2 |
| 0.670 | 97.6 | 0.672 | 97.6 | 0.674 | 97.6 | 0.676 | 96.0 | 0.678 | 96.2 |
| 0.680 | 97.8 | 0.682 | 97.8 | 0.684 | 97.8 | 0.686 | 96.0 | 0.688 | 96.2 |
| 0.690 | 98.0 | 0.692 | 98.0 | 0.694 | 98.0 | 0.696 | 96.0 | 0.698 | 96.2 |
| 0.700 | 98.2 | 0.702 | 98.2 | 0.704 | 98.2 | 0.706 | 96.0 | 0.708 | 96.2 |
| 0.710 | 98.4 | 0.712 | 98.4 | 0.714 | 98.4 | 0.716 | 96.0 | 0.718 | 96.2 |
| 0.720 | 98.6 | 0.722 | 98.6 | 0.724 | 98.6 | 0.726 | 96.0 | 0.728 | 96.2 |
| 0.730 | 98.8 | 0.732 | 98.8 | 0.734 | 98.8 | 0.736 | 96.0 | 0.738 | 96.2 |
| 0.740 | 99.0 | 0.742 | 99.0 | 0.744 | 99.0 | 0.746 | 96.0 | 0.748 | 96.2 |
| 0.750 | 99.2 | 0.752 | 99.2 | 0.754 | 99.2 | 0.756 | 96.0 | 0.758 | 96.2 |
| 0.760 | 99.4 | 0.762 | 99.4 | 0.764 | 99.4 | 0.766 | 96.0 | 0.768 | 96.2 |
| 0.770 | 99.6 | 0.772 | 99.6 | 0.774 | 99.6 | 0.776 | 96.0 | 0.778 | 96.2 |
| 0.780 | 99.8 | 0.782 | 99.8 | 0.784 | 99.8 | 0.786 | 96.0 | 0.788 | 96.2 |
| 0.790 | 100.0 | 0.792 | 100.0 | 0.794 | 100.0 | 0.796 | 96.0 | 0.798 | 96.2 |
| 0.800 | 100.2 | 0.802 | 100.2 | 0.804 | 100.2 | 0.806 | 96.0 | 0.808 | 96.2 |
| 0.810 | 100.4 | 0.812 | 100.4 | 0.814 | 100.4 | 0.816 | 96.0 | 0.818 | 96.2 |
| 0.820 | 100.6 | 0.822 | 100.6 | 0.824 | 100.6 | 0.826 | 96.0 | 0.828 | 96.2 |
| 0.830 | 100.8 | 0.832 | 100.8 | 0.834 | 100.8 | 0.836 | 96.0 | 0.838 | 96.2 |
| 0.840 | 101.0 | 0.842 | 101.0 | 0.844 | 101.0 | 0.846 | 96.0 | 0.848 | 96.2 |
| 0.850 | 101.2 | 0.852 | 101.2 | 0.854 | 101.2 | 0.856 | 96.0 | 0.858 | 96.2 |
| 0.860 | 101.4 | 0.862 | 101.4 | 0.864 | 101.4 | 0.866 | 96.0 | 0.868 | 96.2 |
| 0.870 | 101.6 | 0.872 | 101.6 | 0.874 | 101.6 | 0.876 | 96.0 | 0.878 | 96.2 |
| 0.880 | 101.8 | 0.882 | 101.8 | 0.884 | 101.8 | 0.886 | 96.0 | 0.888 | 96.2 |
| 0.890 | 102.0 | 0.892 | 102.0 | 0.894 | 102.0 | 0.896 | 96.0 | 0.898 | 96.2 |
| 0.900 | 102.2 | 0.902 | 102.2 | 0.904 | 102.2 | 0.906 | 96.0 | 0.908 | 96.2 |
| 0.910 | 102.4 | 0.912 | 102.4 | 0.914 | 102.4 | 0.916 | 96.0 | 0.918 | 96.2 |
| 0.920 | 102.6 | 0.922 | 102.6 | 0.924 | 102.6 | 0.926 | 96.0 | 0.928 | 96.2 |
| 0.930 | 102.8 | 0.932 | 102.8 | 0.934 | 102.8 | 0.936 | 96.0 | 0.938 | 96.2 |
| 0.940 | 103.0 | 0.942 | 103.0 | 0.944 | 103.0 | 0.946 | 96.0 | 0.948 | 96.2 |
| 0.950 | 103.2 | 0.952 | 103.2 | 0.954 | 103.2 | 0.956 | 96.0 | 0.958 | 96.2 |
| 0.960 | 103.4 | 0.962 | 103.4 | 0.964 | 103.4 | 0.966 | 96.0 | 0.968 | 96.2 |
| 0.970 | 103.6 | 0.972 | 103.6 | 0.974 | 103.6 | 0.976 | 96.0 | 0.978 | 96.2 |
| 0.980 | 103.8 | 0.982 | 103.8 | 0.984 | 103.8 | 0.986 | 96.0 | 0.988 | 96.2 |
| 0.990 | 104.0 | 0.992 | 104.0 | 0.994 | 104.0 | 0.996 | 96.0 | 0.998 | 96.2 |
| 1.000 | 104.2 | 1.002 | 104.2 | 1.004 | 104.2 | 1.006 | 96.0 | 1.008 | 96.2 |
| 1.010 | 104.4 | 1.012 | 104.4 | 1.014 | 104.4 | 1.016 | 96.0 | 1.018 | 96.2 |
| 1.020 | 104.6 | 1.022 | 104.6 | 1.024 | 104.6 | 1.026 | 96.0 | 1.028 | 96.2 |
| 1.030 | 104.8 | 1.032 | 104.8 | 1.034 | 104.8 | 1.036 | 96.0 | 1.038 | 96.2 |
| 1.040 | 105.0 | 1.042 | 105.0 | 1.044 | 105.0 | 1.046 | 96.0 | 1.048 | 96.2 |
| 1.050 | 105.2 | 1.052 | 105.2 | 1.054 | 105.2 | 1.056 | 96.0 | 1.058 | 96.2 |
| 1.060 | 105.4 | 1.062 | 105.4 | 1.064 | 105.4 | 1.066 | 96.0 | 1.068 | 96.2 |
| 1.070 | 105.6 | 1.072 | 105.6 | 1.074 | 105.6 | 1.076 | 96.0 | 1.078 | 96.2 |
| 1.080 | 105.8 | 1.082 | 105.8 | 1.084 | 105.8 | 1.086 | 96.0 | 1.088 | 96.2 |
| 1.090 | 106.0 | 1.092 | 106.0 | 1.094 | 106.0 | 1.096 | 96.0 | 1.098 | 96.2 |
| 1.100 | 106.2 | 1.102 | 106.2 | 1.104 | 106.2 | 1.106 | 96.0 | 1.108 | 96.2 |
| 1.110 | 106.4 | 1.112 | 106.4 | 1.114 | 106.4 | 1.116 | 96.0 | 1.118 | 96.2 |
| 1.120 | 106.6 | 1.122 | 106.6 | 1.124 | 106.6 | 1.126 | 96.0 | 1.128 | 96.2 |
| 1.130 | 106.8 | 1.132 | 106.8 | 1.134 | 106.8 | 1.136 | 96.0 | 1.138 | 96.2 |
| 1.140 | 107.0 | 1.142 | 107.0 | 1.144 | 107.0 | 1.146 | 96.0 | 1.148 | 96.2 |
| 1.150 | 107.2 | 1.152 | 107.2 | 1.154 | 107.2 | 1.156 | 96.0 | 1.158 | 96.2 |
| 1.160 | 107.4 | 1.162 | 107.4 | 1.164 | 107.4 | 1.166 | 96.0 | 1.168 | 96.2 |
| 1.170 | 107.6 | 1.172 | 107.6 | 1.174 | 107.6 | 1.176 | 96.0 | 1.178 | 96.2 |
| 1.180 | 107.8 | 1.182 | 107.8 | 1.184 | 107.8 | 1.186 | 96.0 | 1.188 | 96.2 |
| 1.190 | 108.0 | 1.192 | 108.0 | 1.194 | 108.0 | 1.196 | 96.0 | 1.198 | 96.2 |
| 1.200 | 108.2 | 1.202 | 108.2 | 1.204 | 108.2 | 1.206 | 96.0 | 1.208 | 96.2 |
| 1.210 | 108.4 | 1.212 | 108.4 | 1.214 | 108.4 | 1.216 | 96.0 | 1.218 | 96.2 |
| 1.220 | 108.6 | 1.222 | 108.6 | 1.224 | 108.6 | 1.226 | 96.0 | 1.228 | 96.2 |
| 1.230 | 108.8 | 1.232 | 108.8 | 1.234 | 108.8 | 1.236 | 96.0 | 1.238 | 96.2 |
| 1.240 | 109.0 | 1.242 | 109.0 | 1.244 | 109.0 | 1.246 | 96.0 | 1.248 | 96.2 |
| 1.250 | 109.2 | 1.252 | 109.2 | 1.254 | 109.2 | 1.256 | 96.0 | 1.258 | 96.2 |
| 1.260 | 109.4 | 1.262 | 109.4 | 1.264 | 109.4 | 1.266 | 96.0 | 1.268 | 96.2 |
| 1.270 | 109.6 | 1.272 | 109.6 | 1.274 | 109.6 | 1.276 | 96.0 | 1.278 | 96.2 |
| 1.280 | 109.8 | 1.282 | 109.8 | 1.284 | 109.8 | 1.286 | 96.0 | 1.288 | 96.2 |
| 1.290 | 110.0 | 1.292 | 110.0 | 1.294 | 110.0 | 1.296 | 96.0 | 1.298 | 96.2 |
| 1.300 | 110.2 | 1.302 | 110.2 | 1.304 | 110.2 | 1.306 | 96.0 | 1.308 | 96.2 |
| 1.310 | 110.4 | 1.312 | 110.4 | 1.314 | 110.4 | 1.316 | 96.0 | 1.318 | 96.2 |
| 1.320 | 110.6 | 1.322 | 110.6 | 1.324 | 110.6 | 1.326 | 96.0 | 1.328 | 96.2 |
| 1.330 | 110.8 | 1.332 | 110.8 | 1.334 | 110.8 | 1.336 | 96.0 | 1.338 | 96.2 |
| 1.340 | 111.0 | 1.342 | 111.0 | 1.344 | 111.0 | 1.346 | 96.0 | 1.348 | 96.2 |
| 1.350 | 111.2 | 1.352 | 111.2 | 1.354 | 111.2 | 1.356 | 96.0 | 1.358 | 96.2 |
| 1.360 | 111.4 | 1.362 | 111.4 | 1.364 | 111.4 | 1.366 | 96.0 | 1.368 | 96.2 |
| 1.370 | 111.6 | 1.372 | 111.6 | 1.374 | 111.6 | 1.376 | 96.0 | 1.378 | 96.2 |
| 1.380 | 111.8 | 1.382 | 111.8 | 1.384 | 111.8 | 1.386 | 96.0 | 1.388 | 96.2 |
| 1.390 | 112.0 | 1.392 | 112.0 | 1.394 | 112.0 | 1.396 | 96.0 | 1.398 | 96.2 |
| 1.400 | 112.2 | 1.402 | 112.2 | 1.404 | 112.2 | 1.406 | 96.0 | 1.408 | 96.2 |
| 1.410 | 112.4 | 1.412 | 112.4 | 1.414 | 112.4 | 1.416 | 96.0 | 1.418 | 96.2 |
| 1.420 | 112.6 | 1.422 | 112.6 | 1.424 | 112.6 | 1.426 | 96.0 | 1.428 | 96.2 |
| 1.430 | 112.8 | 1.432 | 112.8 | 1.434 | 112.8 | 1.436 | 96.0 | 1.438 | 96.2 |
| 1.440 | 113.0 | 1.442 | 113.0 | 1.444 | 113.0 | 1.446 | 96 | | |

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IN SITU, AFTER 503 HOURS EXPOSURE

EFFECT OF SOLAR UV, VACUUM UV, PROTONS, AND ELECTRONS ON

THE REFLECTANCE OF 7971 LOW EXPANSION GLASS IN SITU

ALPHA(S) = 0.108

VS. WAVELENGTH

HEMISPHERICAL SPECTRAL REFLECTANCE

WAVELENGTH (LAMBDA) F (LAMBDA)

| WAVELENGTH
(LAMRDA) | F (LAMRDA) | WAVELENGTH
(LAMRDA) | F (LAMRDA) | WAVELENGTH
(LAMRDA) | F (LAMRDA) | WAVELENGTH
(LAMRDA) | F (LAMRDA) | WAVELENGTH
(LAMRDA) | F (LAMRDA) | WAVELENGTH
(LAMRDA) | F (LAMRDA) |
|------------------------|------------|------------------------|------------|------------------------|------------|------------------------|------------|------------------------|------------|------------------------|------------|
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 | 0.240 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 | 0.250 | 0.0 |
| 0.250 | 7.3 | 0.252 | 7.1 | 0.254 | 7.2 | 0.256 | 7.1 | 0.258 | 7.1 | 0.260 | 7.1 |
| 0.260 | 7.1 | 0.262 | 7.1 | 0.264 | 7.0 | 0.266 | 6.9 | 0.268 | 6.9 | 0.270 | 6.8 |
| 0.270 | 6.9 | 0.272 | 6.8 | 0.274 | 6.7 | 0.276 | 6.7 | 0.278 | 6.8 | 0.280 | 6.8 |
| 0.280 | 6.9 | 0.282 | 7.1 | 0.284 | 7.6 | 0.286 | 8.4 | 0.288 | 9.2 | 0.290 | 10.9 |
| 0.290 | 9.8 | 0.292 | 10.5 | 0.294 | 10.6 | 0.296 | 10.9 | 0.298 | 10.9 | 0.300 | 9.0 |
| 0.300 | 10.7 | 0.302 | 10.0 | 0.304 | 9.6 | 0.306 | 9.4 | 0.308 | 9.0 | 0.310 | 13.5 |
| 0.310 | 8.8 | 0.312 | 9.3 | 0.314 | 10.0 | 0.316 | 11.3 | 0.318 | 13.5 | 0.320 | 44.5 |
| 0.320 | 16.4 | 0.322 | 21.6 | 0.324 | 20.7 | 0.326 | 36.6 | 0.328 | 44.5 | 0.330 | 65.4 |
| 0.330 | 51.3 | 0.332 | 56.1 | 0.334 | 59.8 | 0.336 | 62.6 | 0.338 | 65.4 | 0.340 | 72.4 |
| 0.340 | 67.3 | 0.342 | 64.8 | 0.344 | 70.4 | 0.346 | 70.9 | 0.348 | 72.4 | 0.350 | 75.1 |
| 0.350 | 72.8 | 0.352 | 74.1 | 0.354 | 74.7 | 0.356 | 75.3 | 0.358 | 75.1 | 0.360 | 81.1 |
| 0.360 | 74.8 | 0.362 | 78.3 | 0.364 | 79.4 | 0.366 | 80.3 | 0.368 | 81.1 | 0.370 | 85.1 |
| 0.370 | 82.5 | 0.372 | 83.0 | 0.374 | 83.9 | 0.376 | 84.2 | 0.378 | 85.1 | 0.380 | 87.3 |
| 0.380 | 85.7 | 0.382 | 86.1 | 0.384 | 86.3 | 0.386 | 86.6 | 0.388 | 87.3 | 0.390 | 88.5 |
| 0.390 | 87.4 | 0.392 | 87.7 | 0.394 | 88.1 | 0.396 | 88.3 | 0.398 | 88.5 | 0.400 | 89.4 |
| 0.400 | 89.9 | 0.402 | 89.5 | 0.404 | 90.1 | 0.406 | 90.4 | 0.408 | 90.5 | 0.410 | 91.1 |
| 0.410 | 90.6 | 0.412 | 90.2 | 0.414 | 90.4 | 0.416 | 90.9 | 0.418 | 91.1 | 0.420 | 91.9 |
| 0.420 | 90.4 | 0.422 | 91.6 | 0.424 | 91.8 | 0.426 | 92.6 | 0.428 | 92.8 | 0.430 | 93.0 |
| 0.430 | 91.8 | 0.432 | 92.0 | 0.434 | 92.6 | 0.436 | 93.0 | 0.438 | 93.0 | 0.440 | 93.3 |
| 0.440 | 93.1 | 0.442 | 93.4 | 0.444 | 93.3 | 0.446 | 93.5 | 0.448 | 93.5 | 0.450 | 93.5 |
| 0.450 | 93.3 | 0.452 | 93.2 | 0.454 | 93.2 | 0.456 | 93.1 | 0.458 | 93.3 | 0.460 | 93.3 |
| 0.460 | 93.5 | 0.462 | 93.4 | 0.464 | 93.4 | 0.466 | 93.4 | 0.468 | 93.5 | 0.470 | 93.5 |
| 0.470 | 93.1 | 0.472 | 92.9 | 0.474 | 93.1 | 0.476 | 93.1 | 0.478 | 93.5 | 0.480 | 94.1 |
| 0.480 | 93.4 | 0.482 | 93.3 | 0.484 | 93.4 | 0.486 | 93.8 | 0.488 | 94.1 | 0.490 | 94.6 |
| 0.490 | 94.1 | 0.492 | 94.4 | 0.494 | 94.5 | 0.496 | 94.6 | 0.498 | 94.6 | 0.500 | 95.2 |
| 0.500 | 94.5 | 0.502 | 95.1 | 0.504 | 95.1 | 0.506 | 95.1 | 0.508 | 95.2 | 0.510 | 95.2 |
| 0.510 | 94.8 | 0.512 | 95.2 | 0.514 | 95.2 | 0.516 | 95.2 | 0.518 | 95.4 | 0.520 | 95.4 |
| 0.520 | 95.3 | 0.522 | 95.4 | 0.524 | 95.4 | 0.526 | 95.5 | 0.528 | 95.5 | 0.530 | 95.5 |
| 0.530 | 95.5 | 0.532 | 95.6 | 0.534 | 95.6 | 0.536 | 95.5 | 0.538 | 95.3 | 0.540 | 95.4 |
| 0.540 | 93.1 | 0.542 | 92.7 | 0.544 | 93.5 | 0.546 | 93.5 | 0.548 | 94.0 | 0.550 | 95.5 |
| 0.550 | 95.5 | 0.552 | 95.6 | 0.554 | 95.6 | 0.556 | 95.7 | 0.558 | 95.7 | 0.560 | 95.7 |
| 0.560 | 95.5 | 0.562 | 95.5 | 0.564 | 95.5 | 0.566 | 95.7 | 0.568 | 95.7 | 0.570 | 95.9 |
| 0.570 | 95.8 | 0.572 | 95.8 | 0.574 | 95.8 | 0.576 | 95.7 | 0.578 | 95.7 | 0.580 | 95.9 |
| 0.580 | 96.0 | 0.582 | 95.9 | 0.584 | 95.9 | 0.586 | 95.8 | 0.588 | 95.7 | 0.590 | 95.7 |
| 0.590 | 95.7 | 0.592 | 95.9 | 0.594 | 95.8 | 0.596 | 95.8 | 0.598 | 95.7 | 0.600 | 95.5 |
| 0.600 | 95.4 | 0.602 | 95.4 | 0.604 | 95.4 | 0.606 | 95.4 | 0.608 | 95.4 | 0.610 | 95.5 |
| 0.610 | 95.8 | 0.612 | 95.8 | 0.614 | 95.8 | 0.616 | 95.8 | 0.618 | 95.7 | 0.620 | 95.7 |
| 0.620 | 95.7 | 0.622 | 95.7 | 0.624 | 95.7 | 0.626 | 95.7 | 0.628 | 95.7 | 0.630 | 95.7 |
| 0.630 | 95.7 | 0.632 | 95.7 | 0.634 | 95.7 | 0.636 | 95.7 | 0.638 | 95.7 | 0.640 | 95.7 |
| 0.640 | 95.7 | 0.642 | 95.7 | 0.644 | 95.7 | 0.646 | 95.7 | 0.648 | 95.7 | 0.650 | 95.7 |
| 0.650 | 95.7 | 0.652 | 95.7 | 0.654 | 95.7 | 0.656 | 95.7 | 0.658 | 95.7 | 0.660 | 95.7 |
| 0.660 | 95.7 | 0.662 | 95.7 | 0.664 | 95.7 | 0.666 | 95.7 | 0.668 | 95.7 | 0.670 | 95.7 |
| 0.670 | 95.7 | 0.672 | 95.7 | 0.674 | 95.7 | 0.676 | 95.7 | 0.678 | 95.7 | 0.680 | 95.7 |
| 0.680 | 95.7 | 0.682 | 95.7 | 0.684 | 95.7 | 0.686 | 95.7 | 0.688 | 95.7 | 0.690 | 95.7 |
| 0.690 | 95.7 | 0.692 | 95.7 | 0.694 | 95.7 | 0.696 | 95.7 | 0.698 | 95.7 | 0.700 | 95.7 |
| 0.700 | 95.7 | 0.702 | 95.7 | 0.704 | 95.7 | 0.706 | 95.7 | 0.708 | 95.7 | 0.710 | 95.7 |
| 0.710 | 95.7 | 0.712 | 95.7 | 0.714 | 95.7 | 0.716 | 95.7 | 0.718 | 95.7 | 0.720 | 95.7 |
| 0.720 | 95.7 | 0.722 | 95.7 | 0.724 | 95.7 | 0.726 | 95.7 | 0.728 | 95.7 | 0.730 | 95.7 |
| 0.730 | 95.7 | 0.732 | 95.7 | 0.734 | 95.7 | 0.736 | 95.7 | 0.738 | 95.7 | 0.740 | 95.7 |
| 0.740 | 95.7 | 0.742 | 95.7 | 0.744 | 95.7 | 0.746 | 95.7 | 0.748 | 95.7 | 0.750 | 95.7 |
| 0.750 | 95.7 | 0.752 | 95.7 | 0.754 | 95.7 | 0.756 | 95.7 | 0.758 | 95.7 | 0.760 | 95.7 |
| 0.760 | 95.7 | 0.762 | 95.7 | 0.764 | 95.7 | 0.766 | 95.7 | 0.768 | 95.7 | 0.770 | 95.7 |
| 0.770 | 95.7 | 0.772 | 95.7 | 0.774 | 95.7 | 0.776 | 95.7 | 0.778 | 95.7 | 0.780 | 95.7 |
| 0.780 | 95.7 | 0.782 | 95.7 | 0.784 | 95.7 | 0.786 | 95.7 | 0.788 | 95.7 | 0.790 | 95.7 |
| 0.790 | 95.7 | 0.792 | 95.7 | 0.794 | 95.7 | 0.796 | 95.7 | 0.798 | 95.7 | 0.800 | 95.7 |
| 0.800 | 95.7 | 0.802 | 95.7 | 0.804 | 95.7 | 0.806 | 95.7 | 0.808 | 95.7 | 0.810 | 95.7 |
| 0.810 | 95.7 | 0.812 | 95.7 | 0.814 | 95.7 | 0.816 | 95.7 | 0.818 | 95.7 | 0.820 | 95.7 |
| 0.820 | 95.7 | 0.822 | 95.7 | 0.824 | 95.7 | 0.826 | 95.7 | 0.828 | 95.7 | 0.830 | 95.7 |
| 0.830 | 95.7 | 0.832 | 95.7 | 0.834 | 95.7 | 0.836 | 95.7 | 0.838 | 95.7 | 0.840 | 95.7 |
| 0.840 | 95.7 | 0.842 | 95.7 | 0.844 | 95.7 | 0.846 | 95.7 | 0.848 | 95.7 | 0.850 | 95.7 |
| 0.850 | 95.7 | 0.852 | 95.7 | 0.854 | 95.7 | 0.856 | 95.7 | 0.858 | 95.7 | 0.860 | 95.7 |
| 0.860 | 95.7 | 0.862 | 95.7 | 0.864 | 95.7 | 0.866 | 95.7 | 0.868 | 95.7 | 0.870 | 95.7 |
| 0.870 | 95.7 | 0.872 | 95.7 | 0.874 | 95.7 | 0.876 | 95.7 | 0.878 | 95.7 | 0.880 | 95.7 |
| 0.880 | 95.7 | 0.882 | 95.7 | 0.884 | 95.7 | 0.886 | 95.7 | 0.888 | 95.7 | 0.890 | 95.7 |
| 0.890 | 95.7 | 0.892 | 95.7 | 0.894 | 95.7 | 0.896 | 95.7 | 0.898 | 95.7 | 0.900 | 95.7 |
| 0.900 | 95.7 | 0.902 | 95.7 | 0.904 | 95.7 | 0.906 | 95.7 | 0.908 | 95.7 | 0.910 | 95.7 |
| 0.910 | 95.7 | 0.912 | 95.7 | 0.914 | 95.7 | 0.916 | 95.7 | 0.918 | 95.7 | 0.920 | 95.7 |
| 0.920 | 95.7 | 0.922 | 95.7 | 0.924 | 95.7 | 0.926 | 95.7 | 0.928 | 95.7 | 0.930 | 95.7 |
| 0.930 | 95.7 | 0.932 | 95.7 | 0.934 | 95.7 | 0.936 | 95.7 | 0.938 | 95.7 | 0.940 | 95.7 |
| 0.940 | 95.7 | 0.942 | 95.7 | 0.944 | 95.7 | 0.946 | 95.7 | 0.948 | 95.7 | 0.950 | 95.7 |
| 0.950 | 95.7 | 0.952 | 95.7 | 0.954 | 95.7 | 0.956 | 95.7 | 0.958 | 95.7 | 0.960 | 95.7 |
| 0.960 | 95.7 | 0.962 | 95.7 | 0.964 | 95.7 | 0.966 | 95.7 | 0.968 | 95.7 | 0.970 | 95.7 |
| 0.970 | 95.7 | 0.972 | 95.7 | 0.974 | 95.7 | 0.976 | 95.7 | 0.978 | 95.7 | 0.980 | 95.7 |
| 0.980 | 95.7 | 0.982 | 95.7 | 0.984 | 95.7 | 0.986 | 95.7 | 0.988 | 95.7 | 0.990 | 95.7 |
| 0.990 | 95.7 | 0.992 | 95.7 | 0.994 | 95.7 | 0.996 | 95.7 | 0.998 | 95.7 | 1.000 | 95.7 |
| 1.000 | 95.7 | 1.002 | 95.7 | 1.004 | 95.7 | 1.006 | 95.7 | 1.008 | 95.7 | 1.010 | 95.7 |
| 1.010 | 95.7 | 1.012 | 95.7 | 1.014 | 95.7 | 1.016 | 95.7 | 1.018 | 95.7 | 1.020 | 95.7 |
| 1.020 | 95.7 | 1.022 | 95.7 | 1.024 | 95.7 | 1.026 | 95.7 | 1.028 | 95.7 | 1.030 | 95.7 |
| 1.030 | 95.7 | 1.032 | 95.7 | 1.034 | 95.7 | 1.036 | 95.7 | 1.038 | 95.7 | 1.040 | 95.7 |
| 1.040 | 95.7 | 1.042 | 95.7 | 1.044 | 95.7 | 1.046 | 95.7 | 1.048 | 95.7 | 1.050 | 95.7 |
| 1.050 | 95.7 | 1.052 | 95.7 | 1.054 | 95.7 | 1.056 | 95.7 | 1.058 | 95.7 | 1.060 | 95.7 |
| 1.060 | 95.7 | 1.062 | 95.7 | 1.064 | 95.7 | 1.066 | 95.7 | 1.068 | 95.7 | 1.070 | 95.7 |
| 1.070 | 95.7 | 1.072 | 95.7 | 1.074 | 95.7 | 1.076 | 95.7 | 1.078 | 95.7 | 1.080 | 95.7 |
| 1.080 | 95.7 | 1.082 | 95.7 | 1.084 | 95.7 | 1.086 | 95.7 | 1.088 | 95.7 | 1.090 | 95.7 |
| 1.090 | 95.7 | 1.092 | 95.7 | 1.094 | 95.7 | 1.096 | 95.7 | 1.098 | 95.7 | 1.100 | 95.7 |
| 1.100 | 95.7 | 1.102 | 95.7 | 1.104 | 95.7 | 1.106 | 95.7 | 1.108 | 95.7 | 1.110 | 95.7 |
| 1.110 | 95.7 | 1.112 | 95.7 | 1.114 | 95.7 | 1.116 | 95.7 | 1.118 | 95.7 | 1.120 | 95.7 |
| 1.120 | 95.7 | 1.122 | 95.7 | 1.124 | 95.7 | 1.126 | 95.7 | 1.128 | 95.7 | 1.130 | 95.7 |
| 1.130 | 95.7 | 1.132</ | | | | | | | | | |

FIGURE . EFFECT OF SOLAR UV, VACUUM UV, PROTONS, AND ELECTRONS ON

THE REFLECTANCE OF 7971 LUM EXPANSION GLASS IN SITU

IN VACUUM, BEFORE EXP. USE

| HEMISPHERICAL SPECTRAL REFLECTANCE | | | | VS. WAVELENGTH | | | | ALPHA(S) = 0.083 | | | |
|------------------------------------|-----------|------------------------|-----------|------------------------|-----------|------------------------|-----------|------------------------|-----------|------------------------|-----------|
| WAVELENGTH
(LAMBDA) | F(LAMBDA) | WAVELENGTH
(LAMBDA) | F(LAMBDA) | WAVELENGTH
(LAMBDA) | F(LAMBDA) | WAVELENGTH
(LAMBDA) | F(LAMBDA) | WAVELENGTH
(LAMBDA) | F(LAMBDA) | WAVELENGTH
(LAMBDA) | F(LAMBDA) |
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 | 0.240 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 | 0.250 | 0.0 |
| 0.250 | 6.1 | 0.252 | 6.0 | 0.254 | 6.0 | 0.256 | 6.0 | 0.258 | 6.0 | 0.260 | 6.0 |
| 0.260 | 5.9 | 0.262 | 6.1 | 0.264 | 5.9 | 0.266 | 5.9 | 0.268 | 5.8 | 0.270 | 5.7 |
| 0.270 | 5.7 | 0.272 | 5.5 | 0.274 | 5.6 | 0.276 | 5.6 | 0.278 | 5.6 | 0.280 | 5.6 |
| 0.280 | 5.9 | 0.282 | 6.2 | 0.284 | 6.0 | 0.286 | 6.8 | 0.288 | 7.7 | 0.290 | 8.5 |
| 0.290 | 9.3 | 0.292 | 10.1 | 0.294 | 10.4 | 0.296 | 10.4 | 0.298 | 10.7 | 0.300 | 10.7 |
| 0.300 | 10.6 | 0.302 | 10.0 | 0.304 | 9.8 | 0.306 | 9.8 | 0.308 | 8.9 | 0.310 | 8.5 |
| 0.310 | 8.2 | 0.312 | 8.1 | 0.314 | 8.2 | 0.316 | 8.2 | 0.318 | 9.2 | 0.320 | 11.2 |
| 0.320 | 14.6 | 0.322 | 21.2 | 0.324 | 28.9 | 0.326 | 28.9 | 0.328 | 39.3 | 0.330 | 49.3 |
| 0.330 | 58.6 | 0.332 | 65.1 | 0.334 | 69.6 | 0.336 | 69.6 | 0.338 | 72.4 | 0.340 | 75.6 |
| 0.340 | 77.0 | 0.342 | 79.1 | 0.344 | 80.3 | 0.346 | 80.3 | 0.348 | 81.8 | 0.350 | 82.5 |
| 0.350 | 83.3 | 0.352 | 83.9 | 0.354 | 84.2 | 0.356 | 84.2 | 0.358 | 85.3 | 0.360 | 86.8 |
| 0.360 | 86.3 | 0.362 | 87.6 | 0.364 | 88.5 | 0.366 | 88.5 | 0.368 | 89.4 | 0.370 | 90.1 |
| 0.370 | 91.1 | 0.372 | 91.6 | 0.374 | 91.7 | 0.376 | 91.7 | 0.378 | 92.0 | 0.380 | 91.9 |
| 0.380 | 92.7 | 0.382 | 93.1 | 0.384 | 93.4 | 0.386 | 93.4 | 0.388 | 93.5 | 0.390 | 94.0 |
| 0.390 | 93.9 | 0.392 | 94.1 | 0.394 | 94.0 | 0.396 | 94.0 | 0.398 | 94.1 | 0.400 | 94.4 |
| 0.400 | 94.6 | 0.402 | 94.1 | 0.404 | 94.0 | 0.406 | 94.0 | 0.408 | 93.9 | 0.410 | 94.2 |
| 0.410 | 94.0 | 0.412 | 94.2 | 0.414 | 94.0 | 0.416 | 94.1 | 0.418 | 94.0 | 0.420 | 94.5 |
| 0.420 | 94.0 | 0.422 | 94.3 | 0.424 | 94.0 | 0.426 | 94.0 | 0.428 | 94.0 | 0.430 | 94.5 |
| 0.430 | 94.7 | 0.432 | 94.7 | 0.434 | 94.7 | 0.436 | 94.7 | 0.438 | 94.7 | 0.440 | 94.6 |
| 0.440 | 94.7 | 0.442 | 95.1 | 0.444 | 95.3 | 0.446 | 95.3 | 0.448 | 95.2 | 0.450 | 95.0 |
| 0.450 | 95.7 | 0.452 | 95.6 | 0.454 | 95.5 | 0.456 | 95.5 | 0.458 | 95.6 | 0.460 | 95.4 |
| 0.460 | 95.6 | 0.462 | 95.6 | 0.464 | 95.5 | 0.466 | 95.5 | 0.468 | 95.4 | 0.470 | 95.6 |
| 0.470 | 95.8 | 0.472 | 95.5 | 0.474 | 95.5 | 0.476 | 95.7 | 0.478 | 95.4 | 0.480 | 95.3 |
| 0.480 | 95.6 | 0.482 | 95.6 | 0.484 | 95.6 | 0.486 | 95.4 | 0.488 | 95.4 | 0.490 | 95.5 |
| 0.490 | 95.5 | 0.492 | 95.5 | 0.494 | 95.5 | 0.496 | 95.6 | 0.498 | 95.4 | 0.500 | 95.2 |
| 0.500 | 95.5 | 0.502 | 95.4 | 0.504 | 95.4 | 0.506 | 95.4 | 0.508 | 95.4 | 0.510 | 95.0 |
| 0.510 | 95.4 | 0.512 | 95.4 | 0.514 | 95.4 | 0.516 | 95.4 | 0.518 | 95.4 | 0.520 | 95.0 |
| 0.520 | 95.3 | 0.522 | 95.4 | 0.524 | 95.4 | 0.526 | 95.4 | 0.528 | 95.4 | 0.530 | 94.6 |
| 0.530 | 94.7 | 0.532 | 95.1 | 0.534 | 95.3 | 0.536 | 95.3 | 0.538 | 95.2 | 0.540 | 94.8 |
| 0.540 | 94.7 | 0.542 | 95.6 | 0.544 | 95.5 | 0.546 | 95.5 | 0.548 | 95.6 | 0.550 | 95.0 |
| 0.550 | 95.7 | 0.552 | 95.6 | 0.554 | 95.6 | 0.556 | 95.5 | 0.558 | 95.6 | 0.560 | 95.4 |
| 0.560 | 95.6 | 0.562 | 95.6 | 0.564 | 95.5 | 0.566 | 95.7 | 0.568 | 95.4 | 0.570 | 95.6 |
| 0.570 | 95.8 | 0.572 | 95.5 | 0.574 | 95.5 | 0.576 | 95.7 | 0.578 | 95.4 | 0.580 | 95.3 |
| 0.580 | 95.6 | 0.582 | 95.5 | 0.584 | 95.5 | 0.586 | 95.4 | 0.588 | 95.4 | 0.590 | 95.6 |
| 0.590 | 95.5 | 0.592 | 95.5 | 0.594 | 95.5 | 0.596 | 95.4 | 0.598 | 95.7 | 0.600 | 95.4 |
| 0.600 | 95.4 | 0.602 | 95.4 | 0.604 | 95.4 | 0.606 | 95.4 | 0.608 | 95.7 | 0.610 | 95.6 |
| 0.610 | 95.3 | 0.612 | 95.4 | 0.614 | 95.4 | 0.616 | 95.4 | 0.618 | 95.7 | 0.620 | 95.6 |
| 0.620 | 95.6 | 0.622 | 95.8 | 0.624 | 95.8 | 0.626 | 95.8 | 0.628 | 95.8 | 0.630 | 95.6 |
| 0.630 | 95.8 | 0.632 | 95.5 | 0.634 | 95.5 | 0.636 | 95.7 | 0.638 | 95.4 | 0.640 | 95.3 |
| 0.640 | 95.6 | 0.642 | 95.6 | 0.644 | 95.6 | 0.646 | 95.4 | 0.648 | 95.4 | 0.650 | 95.5 |
| 0.650 | 95.5 | 0.652 | 95.5 | 0.654 | 95.5 | 0.656 | 95.6 | 0.658 | 95.4 | 0.660 | 95.3 |
| 0.660 | 95.5 | 0.662 | 95.4 | 0.664 | 95.4 | 0.666 | 95.4 | 0.668 | 95.4 | 0.670 | 95.2 |
| 0.670 | 95.4 | 0.672 | 95.4 | 0.674 | 95.4 | 0.676 | 95.4 | 0.678 | 95.4 | 0.680 | 95.0 |
| 0.680 | 95.3 | 0.682 | 95.4 | 0.684 | 95.4 | 0.686 | 95.4 | 0.688 | 95.7 | 0.690 | 95.7 |
| 0.690 | 95.3 | 0.692 | 95.6 | 0.694 | 95.6 | 0.696 | 95.7 | 0.698 | 95.7 | 0.700 | 95.9 |
| 0.700 | 95.6 | 0.702 | 95.8 | 0.704 | 95.8 | 0.706 | 95.8 | 0.708 | 95.8 | 0.710 | 95.8 |
| 0.710 | 95.6 | 0.712 | 95.9 | 0.714 | 95.9 | 0.716 | 95.9 | 0.718 | 95.8 | 0.720 | 95.9 |
| 0.720 | 95.7 | 0.722 | 95.9 | 0.724 | 95.9 | 0.726 | 95.9 | 0.728 | 95.9 | 0.730 | 95.0 |
| 0.730 | 95.0 | 0.732 | 96.1 | 0.734 | 96.1 | 0.736 | 96.0 | 0.738 | 95.6 | 0.740 | 96.0 |
| 0.740 | 95.4 | 0.742 | 96.1 | 0.744 | 96.1 | 0.746 | 96.2 | 0.748 | 96.4 | 0.750 | 96.2 |
| 0.750 | 96.0 | 0.752 | 96.1 | 0.754 | 96.1 | 0.756 | 96.5 | 0.758 | 96.3 | 0.760 | 96.5 |
| 0.760 | 96.2 | 0.762 | 96.4 | 0.764 | 96.4 | 0.766 | 96.5 | 0.768 | 96.5 | 0.770 | 96.4 |
| 0.770 | 96.6 | 0.772 | 96.6 | 0.774 | 96.6 | 0.776 | 96.6 | 0.778 | 96.5 | 0.780 | 96.4 |
| 0.780 | 96.0 | 0.782 | 96.6 | 0.784 | 96.6 | 0.786 | 96.6 | 0.788 | 96.5 | 0.790 | 96.4 |
| 0.790 | 96.5 | 0.792 | 96.6 | 0.794 | 96.6 | 0.796 | 96.6 | 0.798 | 96.9 | 0.800 | 96.4 |
| 0.800 | 96.5 | 0.802 | 96.7 | 0.804 | 96.7 | 0.806 | 96.8 | 0.808 | 96.7 | 0.810 | 96.4 |
| 0.810 | 97.0 | 0.812 | 96.8 | 0.814 | 96.8 | 0.816 | 96.7 | 0.818 | 96.7 | 0.820 | 96.4 |
| 0.820 | 97.5 | 0.822 | 96.8 | 0.824 | 96.8 | 0.826 | 96.7 | 0.828 | 96.5 | 0.830 | 96.4 |
| 0.830 | 96.2 | 0.832 | 96.6 | 0.834 | 96.6 | 0.836 | 96.6 | 0.838 | 96.5 | 0.840 | 96.4 |
| 0.840 | 96.5 | 0.842 | 96.6 | 0.844 | 96.6 | 0.846 | 96.6 | 0.848 | 96.5 | 0.850 | 96.4 |
| 0.850 | 96.0 | 0.852 | 96.6 | 0.854 | 96.6 | 0.856 | 96.6 | 0.858 | 96.5 | 0.860 | 96.4 |
| 0.860 | 96.5 | 0.862 | 96.6 | 0.864 | 96.6 | 0.866 | 96.6 | 0.868 | 96.5 | 0.870 | 96.4 |
| 0.870 | 96.5 | 0.872 | 96.6 | 0.874 | 96.6 | 0.876 | 96.6 | 0.878 | 96.5 | 0.880 | 96.4 |
| 0.880 | 97.0 | 0.882 | 96.8 | 0.884 | 96.8 | 0.886 | 96.7 | 0.888 | 96.7 | 0.890 | 96.4 |
| 0.890 | 97.5 | 0.892 | 96.8 | 0.894 | 96.8 | 0.896 | 96.7 | 0.898 | 96.5 | 0.900 | 96.4 |
| 0.900 | 96.2 | 0.902 | 96.6 | 0.904 | 96.6 | 0.906 | 96.6 | 0.908 | 96.5 | 0.910 | 96.4 |
| 0.910 | 96.5 | 0.912 | 96.6 | 0.914 | 96.6 | 0.916 | 96.6 | 0.918 | 96.5 | 0.920 | 96.4 |
| 0.920 | 97.0 | 0.922 | 96.8 | 0.924 | 96.8 | 0.926 | 96.7 | 0.928 | 96.7 | 0.930 | 96.4 |
| 0.930 | 96.2 | 0.932 | 96.6 | 0.934 | 96.6 | 0.936 | 96.6 | 0.938 | 96.5 | 0.940 | 96.4 |
| 0.940 | 96.5 | 0.942 | 96.6 | 0.944 | 96.6 | 0.946 | 96.6 | 0.948 | 96.5 | 0.950 | 96.4 |
| 0.950 | 97.0 | 0.952 | 96.8 | 0.954 | 96.8 | 0.956 | 96.7 | 0.958 | 96.5 | 0.960 | 96.4 |
| 0.960 | 96.2 | 0.962 | 96.6 | 0.964 | 96.6 | 0.966 | 96.6 | 0.968 | 96.5 | 0.970 | 96.4 |
| 0.970 | 96.5 | 0.972 | 96.6 | 0.974 | 96.6 | 0.976 | 96.6 | 0.978 | 96.5 | 0.980 | 96.4 |
| 0.980 | 97.0 | 0.982 | 96.8 | 0.984 | 96.8 | 0.986 | 96.7 | 0.988 | 96.7 | 0.990 | 96.4 |
| 0.990 | 96.2 | 0.992 | 96.6 | 0.994 | 96.6 | 0.996 | 96.6 | 0.998 | 96.5 | 1.000 | 96.4 |
| 1.000 | 96.5 | 1.002 | 96.6 | 1.004 | 96.6 | 1.006 | 96.6 | 1.008 | 96.5 | 1.010 | 96.4 |
| 1.010 | 97.0 | 1.012 | 96.8 | 1.014 | 96.8 | 1.016 | 96.7 | 1.018 | 96.5 | 1.020 | 96.4 |
| 1.020 | 96.2 | 1.022 | 96.6 | 1.024 | 96.6 | 1.026 | 96.6 | 1.028 | 96.5 | 1.030 | 96.4 |
| 1.030 | 96.5 | 1.032 | 96.6 | 1.034 | 96.6 | 1.036 | 96.6 | 1.038 | 96.5 | 1.040 | 96.4 |
| 1.040 | 97.0 | 1.042 | 96.8 | 1.044 | 96.8 | 1.046 | 96.7 | 1.048 | 96.7 | 1.050 | 96.4 |
| 1.050 | 96.2 | 1.052 | 96.6 | 1.054 | 96.6 | 1.056 | 96.6 | 1.058 | 96.5 | 1.060 | 96.4 |
| 1.060 | 96.5 | 1.062 | 96.6 | 1.064 | 96.6 | 1.066 | 96.6 | 1.068 | 96.5 | 1.070 | 96.4 |
| 1.070 | 97.0 | 1.072 | 96.8 | 1.074 | 96.8 | 1.076 | 96.7 | 1.078 | 96.5 | 1.080 | 96.4 |
| 1.080 | 96.2 | 1.082 | 96.6 | 1.084 | 96.6 | 1.086 | 96.6 | 1.088 | 96.5 | 1.090 | 96.4 |
| 1.090 | 96.5 | 1.092 | 96.6 | 1.094 | 96.6 | 1.096 | 96.6 | 1.098 | 96.5 | 1.100 | 96.4 |
| 1.100 | 97.0 | 1.102 | 96.8 | 1.104 | 96.8 | 1.106 | 96.7 | 1.108 | 96.7 | 1.110 | 96.4 |
| 1.110 | 96.2 | 1.112 | 96.6 | 1.114 | 96.6 | 1.116 | | | | | |

$$\text{ALPHA}(3) = 0.008$$

| WAVELENGTH
(λ Å) | $F(\lambda)$ | WAVELENGTH
(λ Å) | $F(\lambda)$ | WAVELENGTH
(λ Å) | $F(\lambda)$ | WAVELENGTH
(λ Å) | $F(\lambda)$ | WAVELENGTH
(λ Å) | $F(\lambda)$ | WAVELENGTH
(λ Å) | $F(\lambda)$ |
|------------------------------|--------------|------------------------------|--------------|------------------------------|--------------|------------------------------|--------------|------------------------------|--------------|------------------------------|--------------|
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 | 0.240 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 | 0.250 | 0.0 |
| 0.250 | 6.3 | 0.252 | 6.3 | 0.254 | 6.3 | 0.256 | 6.3 | 0.258 | 6.3 | 0.260 | 6.3 |
| 0.260 | 6.2 | 0.262 | 6.1 | 0.264 | 6.0 | 0.266 | 6.0 | 0.268 | 5.8 | 0.270 | 5.9 |
| 0.270 | 5.9 | 0.272 | 5.8 | 0.274 | 5.7 | 0.276 | 5.6 | 0.278 | 5.4 | 0.280 | 5.9 |
| 0.280 | 6.1 | 0.282 | 6.5 | 0.284 | 7.0 | 0.286 | 7.0 | 0.288 | 7.0 | 0.290 | 6.0 |
| 0.290 | 9.5 | 0.292 | 10.0 | 0.294 | 10.5 | 0.296 | 10.9 | 0.298 | 10.9 | 0.300 | 10.9 |
| 0.300 | 10.6 | 0.302 | 10.2 | 0.304 | 9.6 | 0.306 | 9.1 | 0.308 | 8.5 | 0.310 | 8.5 |
| 0.310 | 6.2 | 0.312 | 6.1 | 0.314 | 6.5 | 0.316 | 6.4 | 0.318 | 6.4 | 0.320 | 6.4 |
| 0.320 | 14.8 | 0.322 | 20.9 | 0.324 | 29.2 | 0.326 | 39.4 | 0.328 | 49.4 | 0.330 | 49.4 |
| 0.330 | 50.1 | 0.332 | 65.1 | 0.334 | 69.5 | 0.336 | 72.6 | 0.338 | 75.1 | 0.340 | 75.1 |
| 0.340 | 77.6 | 0.342 | 74.4 | 0.344 | 80.0 | 0.346 | 80.6 | 0.348 | 81.7 | 0.350 | 81.7 |
| 0.350 | 62.3 | 0.352 | 83.9 | 0.354 | 94.0 | 0.356 | 85.3 | 0.358 | 85.3 | 0.360 | 85.2 |
| 0.360 | 85.0 | 0.362 | 86.0 | 0.364 | 87.1 | 0.366 | 87.5 | 0.368 | 88.6 | 0.370 | 88.6 |
| 0.370 | 89.5 | 0.372 | 89.5 | 0.374 | 89.9 | 0.376 | 90.2 | 0.378 | 90.8 | 0.380 | 90.8 |
| 0.380 | 91.2 | 0.382 | 91.1 | 0.384 | 91.8 | 0.386 | 91.8 | 0.388 | 92.3 | 0.390 | 92.3 |
| 0.390 | 92.8 | 0.392 | 92.6 | 0.394 | 92.5 | 0.396 | 92.7 | 0.398 | 93.1 | 0.400 | 93.1 |
| 0.400 | 92.7 | 0.402 | 92.5 | 0.404 | 92.9 | 0.406 | 92.7 | 0.408 | 93.1 | 0.410 | 93.1 |
| 0.410 | 93.0 | 0.412 | 93.2 | 0.414 | 93.1 | 0.416 | 93.3 | 0.418 | 93.3 | 0.420 | 93.3 |
| 0.420 | 93.5 | 0.422 | 93.7 | 0.424 | 93.8 | 0.426 | 93.9 | 0.428 | 93.9 | 0.430 | 93.9 |
| 0.430 | 93.9 | 0.432 | 94.4 | 0.434 | 94.5 | 0.436 | 94.5 | 0.438 | 94.5 | 0.440 | 94.5 |
| 0.440 | 94.5 | 0.442 | 94.7 | 0.444 | 94.5 | 0.446 | 95.1 | 0.448 | 95.1 | 0.450 | 95.1 |
| 0.450 | 94.9 | 0.452 | 94.8 | 0.454 | 95.1 | 0.456 | 95.1 | 0.458 | 95.1 | 0.460 | 95.1 |
| 0.460 | 94.9 | 0.462 | 94.8 | 0.464 | 95.1 | 0.466 | 95.1 | 0.468 | 95.1 | 0.470 | 95.1 |
| 0.470 | 94.9 | 0.472 | 94.8 | 0.474 | 95.1 | 0.476 | 95.1 | 0.478 | 95.1 | 0.480 | 95.1 |
| 0.480 | 94.9 | 0.482 | 94.8 | 0.484 | 95.1 | 0.486 | 95.1 | 0.488 | 95.1 | 0.490 | 95.1 |
| 0.490 | 94.9 | 0.492 | 94.8 | 0.494 | 95.1 | 0.496 | 95.1 | 0.498 | 95.1 | 0.500 | 95.1 |
| 0.500 | 94.9 | 0.502 | 94.8 | 0.504 | 95.1 | 0.506 | 95.1 | 0.508 | 95.1 | 0.510 | 95.1 |
| 0.510 | 94.9 | 0.512 | 94.8 | 0.514 | 95.1 | 0.516 | 95.1 | 0.518 | 95.1 | 0.520 | 95.1 |
| 0.520 | 94.9 | 0.522 | 94.8 | 0.524 | 95.1 | 0.526 | 95.1 | 0.528 | 95.1 | 0.530 | 95.1 |
| 0.530 | 94.9 | 0.532 | 94.8 | 0.534 | 95.1 | 0.536 | 95.1 | 0.538 | 95.1 | 0.540 | 95.1 |
| 0.540 | 94.9 | 0.542 | 94.8 | 0.544 | 95.1 | 0.546 | 95.1 | 0.548 | 95.1 | 0.550 | 95.1 |
| 0.550 | 94.9 | 0.552 | 94.8 | 0.554 | 95.1 | 0.556 | 95.1 | 0.558 | 95.1 | 0.560 | 95.1 |

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FIGURE 1. EFFECT OF SOLAR UV, VACUUM UV, PROTONS, AND ELECTRONS ON THE REFLECTANCE OF 7971 LOW EXPANSION GLASS IN SITU IN SITU, A

IN SITU, AFTER 150 HOURS EXPOSURE

ALPHA(8) = 0.090

84. WAVELENGTH

HEMISPHERICAL SPECTRAL REFLECTANCE

| WAVELENGTH
(λ MPDA) | F(λ MPDA) | WAVELENGTH
(λ MPDA) | F(λ MPDA) | WAVELENGTH
(λ MPDA) | F(λ MPDA) | WAVELENGTH
(λ MPDA) | F(λ MPDA) |
|---------------------------------|--------------------|---------------------------------|--------------------|---------------------------------|--------------------|---------------------------------|--------------------|
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 |
| 0.250 | 6.6 | 0.252 | 6.6 | 0.254 | 6.7 | 0.256 | 6.6 |
| 0.260 | 6.7 | 0.262 | 6.6 | 0.264 | 6.6 | 0.266 | 6.6 |
| 0.270 | 6.3 | 0.272 | 6.4 | 0.274 | 6.2 | 0.276 | 6.3 |
| 0.280 | 6.7 | 0.282 | 7.1 | 0.284 | 7.7 | 0.286 | 8.5 |
| 0.290 | 10.0 | 0.292 | 10.7 | 0.294 | 11.0 | 0.296 | 11.2 |
| 0.300 | 10.8 | 0.302 | 10.4 | 0.304 | 9.7 | 0.306 | 9.3 |
| 0.310 | 8.7 | 0.312 | 8.7 | 0.314 | 9.0 | 0.316 | 9.8 |
| 0.320 | 15.7 | 0.322 | 21.4 | 0.324 | 29.8 | 0.326 | 39.9 |
| 0.330 | 57.6 | 0.332 | 63.7 | 0.334 | 69.1 | 0.336 | 71.0 |
| 0.340 | 75.5 | 0.342 | 77.0 | 0.344 | 77.5 | 0.346 | 76.8 |
| 0.350 | 81.0 | 0.352 | 81.3 | 0.354 | 82.4 | 0.356 | 82.5 |
| 0.360 | 84.1 | 0.362 | 85.0 | 0.364 | 86.4 | 0.366 | 87.3 |
| 0.370 | 88.7 | 0.372 | 89.2 | 0.374 | 89.8 | 0.376 | 90.0 |
| 0.380 | 90.8 | 0.382 | 90.9 | 0.384 | 91.5 | 0.386 | 91.3 |
| 0.390 | 91.8 | 0.392 | 92.0 | 0.394 | 91.7 | 0.396 | 92.2 |
| 0.400 | 92.8 | 0.402 | 92.3 | 0.404 | 92.7 | 0.406 | 92.3 |
| 0.410 | 92.8 | 0.412 | 92.7 | 0.414 | 92.6 | 0.416 | 92.6 |
| 0.420 | 93.3 | 0.422 | 93.0 | 0.424 | 92.8 | 0.426 | 93.1 |
| 0.430 | 93.7 | 0.432 | 93.4 | 0.434 | 93.8 | 0.436 | 93.7 |
| 0.440 | 94.3 | 0.442 | 94.3 | 0.444 | 94.0 | 0.446 | 94.1 |
| 0.450 | 94.8 | 0.452 | 94.8 | 0.454 | 94.8 | 0.456 | 95.0 |
| 0.460 | 95.0 | 0.462 | 94.7 | 0.464 | 94.6 | 0.466 | 94.9 |
| 0.470 | 95.0 | 0.472 | 94.9 | 0.474 | 94.6 | 0.476 | 94.5 |
| 0.480 | 95.0 | 0.482 | 94.8 | 0.484 | 94.5 | 0.486 | 94.5 |
| 0.490 | 95.0 | 0.492 | 94.7 | 0.494 | 94.9 | 0.496 | 95.0 |
| 0.500 | 95.0 | 0.502 | 94.7 | 0.504 | 94.8 | 0.506 | 94.8 |
| 0.510 | 95.0 | 0.512 | 95.3 | 0.514 | 95.3 | 0.516 | 95.3 |
| 0.520 | 95.0 | 0.522 | 95.5 | 0.524 | 95.6 | 0.526 | 95.5 |
| 0.530 | 95.0 | 0.532 | 95.7 | 0.534 | 95.7 | 0.536 | 96.0 |
| 0.540 | 95.0 | 0.542 | 95.9 | 0.544 | 95.7 | 0.546 | 95.8 |
| 0.550 | 95.0 | 0.552 | 96.0 | 0.554 | 95.9 | 0.556 | 95.8 |
| 0.560 | 95.0 | 0.562 | 96.1 | 0.564 | 96.0 | 0.566 | 96.0 |
| 0.570 | 95.0 | 0.572 | 96.1 | 0.574 | 96.0 | 0.576 | 96.0 |
| 0.580 | 95.0 | 0.582 | 96.1 | 0.584 | 96.0 | 0.586 | 96.0 |
| 0.590 | 95.0 | 0.592 | 96.1 | 0.594 | 96.0 | 0.596 | 96.0 |
| 0.600 | 95.0 | 0.602 | 96.1 | 0.604 | 96.0 | 0.606 | 96.0 |
| 0.610 | 95.0 | 0.612 | 96.1 | 0.614 | 96.0 | 0.616 | 96.0 |
| 0.620 | 95.0 | 0.622 | 96.1 | 0.624 | 96.0 | 0.626 | 96.0 |
| 0.630 | 95.0 | 0.632 | 96.1 | 0.634 | 96.0 | 0.636 | 96.0 |
| 0.640 | 95.0 | 0.642 | 96.1 | 0.644 | 96.0 | 0.646 | 96.0 |
| 0.650 | 95.0 | 0.652 | 96.1 | 0.654 | 96.0 | 0.656 | 96.0 |
| 0.660 | 95.0 | 0.662 | 96.1 | 0.664 | 96.0 | 0.666 | 96.0 |
| 0.670 | 95.0 | 0.672 | 96.1 | 0.674 | 96.0 | 0.676 | 96.0 |
| 0.680 | 95.0 | 0.682 | 96.1 | 0.684 | 96.0 | 0.686 | 96.0 |
| 0.690 | 95.0 | 0.692 | 96.1 | 0.694 | 96.0 | 0.696 | 96.0 |
| 0.700 | 95.0 | 0.702 | 96.1 | 0.704 | 96.0 | 0.706 | 96.0 |
| 0.710 | 95.0 | 0.712 | 96.1 | 0.714 | 96.0 | 0.716 | |

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EFFECT OF SOLAR UV, VACUUM UV, PROTONS, AND ELECTRONS ON

THE REFLECTANCE OF 7971 LOW EXPANSION GLASS IN SITU

IN SITU, AFTER 313 HOURS EXPOSURE

ALPHA(8) = 0.097

VS. WAVELENGTH

HEMISPHERICAL SPECTRAL REFLECTANCE

| WAVELENGTH
(λ) | F(λ) | WAVELENGTH
(λ) | F(λ) | WAVELENGTH
(λ) | F(λ) | WAVELENGTH
(λ) | F(λ) | WAVELENGTH
(λ) | F(λ) | WAVELENGTH
(λ) | F(λ) | WAVELENGTH
(λ) | F(λ) | WAVELENGTH
(λ) | F(λ) |
|-----------------------------|----------------|-----------------------------|----------------|-----------------------------|----------------|-----------------------------|----------------|-----------------------------|----------------|-----------------------------|----------------|-----------------------------|----------------|-----------------------------|----------------|
| 0.230 | 0.0 | 0.232 | 0.0 | 0.234 | 0.0 | 0.236 | 0.0 | 0.238 | 0.0 | 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 |
| 0.240 | 0.0 | 0.242 | 0.0 | 0.244 | 0.0 | 0.246 | 0.0 | 0.248 | 0.0 | 0.250 | 0.0 | 0.252 | 0.0 | 0.254 | 0.0 |
| 0.250 | 7.0 | 0.252 | 7.0 | 0.254 | 7.0 | 0.256 | 7.0 | 0.258 | 7.1 | 0.260 | 7.1 | 0.262 | 7.1 | 0.264 | 7.1 |
| 0.260 | 6.8 | 0.262 | 6.8 | 0.264 | 6.8 | 0.266 | 6.8 | 0.268 | 6.8 | 0.270 | 6.8 | 0.272 | 6.8 | 0.274 | 6.8 |
| 0.270 | 6.5 | 0.272 | 6.5 | 0.274 | 6.5 | 0.276 | 6.5 | 0.278 | 6.7 | 0.280 | 6.7 | 0.282 | 6.7 | 0.284 | 6.7 |
| 0.280 | 6.7 | 0.282 | 7.0 | 0.284 | 7.7 | 0.286 | 8.4 | 0.288 | 8.9 | 0.290 | 8.9 | 0.292 | 11.0 | 0.294 | 11.0 |
| 0.290 | 9.9 | 0.292 | 10.3 | 0.294 | 10.9 | 0.296 | 11.2 | 0.298 | 11.5 | 0.300 | 11.5 | 0.302 | 11.5 | 0.304 | 11.5 |
| 0.300 | 10.8 | 0.302 | 10.3 | 0.304 | 9.8 | 0.306 | 9.1 | 0.308 | 8.9 | 0.310 | 8.9 | 0.312 | 8.9 | 0.314 | 8.9 |
| 0.310 | 8.6 | 0.312 | 8.5 | 0.314 | 8.8 | 0.316 | 9.7 | 0.318 | 11.5 | 0.320 | 11.5 | 0.322 | 11.5 | 0.324 | 11.5 |
| 0.320 | 15.0 | 0.322 | 20.8 | 0.324 | 24.2 | 0.326 | 36.1 | 0.328 | 47.6 | 0.330 | 47.6 | 0.332 | 47.6 | 0.334 | 47.6 |
| 0.330 | 55.8 | 0.332 | 61.6 | 0.334 | 66.2 | 0.336 | 68.9 | 0.338 | 70.9 | 0.340 | 70.9 | 0.342 | 70.9 | 0.344 | 70.9 |
| 0.340 | 73.3 | 0.342 | 74.5 | 0.344 | 76.1 | 0.346 | 76.9 | 0.348 | 77.8 | 0.350 | 77.8 | 0.352 | 77.8 | 0.354 | 77.8 |
| 0.350 | 78.7 | 0.352 | 79.1 | 0.354 | 80.3 | 0.356 | 80.8 | 0.358 | 81.5 | 0.360 | 81.5 | 0.362 | 81.5 | 0.364 | 81.5 |
| 0.360 | 81.2 | 0.362 | 82.4 | 0.364 | 83.5 | 0.366 | 84.5 | 0.368 | 85.8 | 0.370 | 85.8 | 0.372 | 85.8 | 0.374 | 85.8 |
| 0.370 | 86.1 | 0.372 | 86.6 | 0.374 | 87.4 | 0.376 | 87.6 | 0.378 | 87.9 | 0.380 | 87.9 | 0.382 | 87.9 | 0.384 | 87.9 |
| 0.380 | 88.5 | 0.382 | 88.7 | 0.384 | 89.3 | 0.386 | 89.8 | 0.388 | 90.0 | 0.390 | 90.0 | 0.392 | 90.0 | 0.394 | 90.0 |
| 0.390 | 90.2 | 0.392 | 90.2 | 0.394 | 89.9 | 0.396 | 90.6 | 0.398 | 90.8 | 0.400 | 90.8 | 0.402 | 90.8 | 0.404 | 90.8 |
| 0.400 | 91.0 | 0.402 | 90.7 | 0.404 | 90.8 | 0.406 | 90.7 | 0.408 | 91.2 | 0.410 | 91.2 | 0.412 | 91.2 | 0.414 | 91.2 |
| 0.410 | 90.7 | 0.412 | 91.2 | 0.414 | 91.3 | 0.416 | 91.9 | 0.418 | 92.0 | 0.420 | 92.0 | 0.422 | 92.0 | 0.424 | 92.0 |
| 0.420 | 91.8 | 0.422 | 91.6 | 0.424 | 91.9 | 0.426 | 92.0 | 0.428 | 92.5 | 0.430 | 92.5 | 0.432 | 92.5 | 0.434 | 92.5 |
| 0.430 | 92.0 | 0.432 | 92.0 | 0.434 | 92.0 | 0.436 | 93.0 | 0.438 | 93.3 | 0.440 | 93.3 | 0.442 | 93.3 | 0.444 | 93.3 |
| 0.440 | 92.6 | 0.442 | 93.1 | 0.444 | 93.0 | 0.446 | 93.0 | 0.448 | 93.4 | 0.450 | 93.4 | 0.452 | 93.4 | 0.454 | 93.4 |
| 0.450 | 93.7 | 0.452 | 94.0 | 0.454 | 94.0 | 0.456 | 94.1 | 0.458 | 94.2 | 0.460 | 94.2 | 0.462 | 94.2 | 0.464 | 94.2 |
| 0.460 | 94.0 | 0.462 | 93.8 | 0.464 | 94.1 | 0.466 | 94.0 | 0.468 | 94.1 | 0.470 | 94.1 | 0.472 | 94.1 | 0.474 | 94.1 |
| 0.470 | 94.3 | 0.472 | 94.2 | 0.474 | 94.0 | 0.476 | 94.0 | 0.478 | 94.1 | 0.480 | 94.1 | 0.482 | 94.1 | 0.484 | 94.1 |
| 0.480 | 93.9 | 0.482 | 94.0 | 0.484 | 94.0 | 0.486 | 94.0 | 0.488 | 94.1 | 0.490 | 94.1 | 0.492 | 94.1 | 0.494 | 94.1 |
| 0.490 | 94.0 | 0.492 | 94.0 | 0.494 | 94.0 | 0.496 | 94.0 | 0.498 | 94.1 | 0.500 | 94.1 | 0.502 | 94.1 | 0.504 | 94.1 |
| 0.500 | 94.0 | 0.502 | 94.0 | 0.504 | 94.0 | 0.506 | 94.0 | 0.508 | 94.1 | 0.510 | 94.1 | 0.512 | 94.1 | 0.514 | 94.1 |
| 0.510 | 94.0 | 0.512 | 94.0 | 0.514 | 94.0 | 0.516 | 94.0 | 0.518 | 94.1 | 0.520 | 94.1 | 0.522 | 94.1 | 0.524 | 94.1 |
| 0.520 | 94.0 | 0.522 | 94.0 | 0.524 | 94.0 | 0.526 | 94.0 | 0.528 | 94.1 | 0.530 | 94.1 | 0.532 | 94.1 | 0.534 | 94.1 |
| 0.530 | 94.0 | 0.532 | 94.0 | 0.534 | 94.0 | 0.536 | 94.0 | 0.538 | 94.1 | 0.540 | 94.1 | 0.542 | 94.1 | 0.544 | 94.1 |
| 0.540 | 94.0 | 0.542 | 94.0 | 0.544 | 94.0 | 0.546 | 94.0 | 0.548 | 94.1 | 0.550 | 94.1 | 0.552 | 94.1 | 0.554 | 94.1 |
| 0.550 | 94.0 | 0.552 | 94.0 | 0.554 | 94.0 | 0.556 | 94.0 | 0.558 | 94.1 | 0.560 | 94.1 | 0.562 | 94.1 | 0.564 | 94.1 |
| 0.560 | 94.0 | 0.562 | 94.0 | 0.564 | 94.0 | 0.566 | 94.0 | 0.568 | 94.1 | 0.570 | 94.1 | 0.572 | 94.1 | 0.574 | 94.1 |
| 0.570 | 94.0 | 0.572 | 94.0 | 0.574 | 94.0 | 0.576 | 94.0 | 0.578 | 94.1 | 0.580 | 94.1 | 0.582 | 94.1 | 0.584 | 94.1 |
| 0.580 | 94.0 | 0.582 | 94.0 | 0.584 | 94.0 | 0.586 | 94.0 | 0.588 | 94.1 | 0.590 | 94.1 | 0.592 | 94.1 | 0.594 | 94.1 |
| 0.590 | 94.0 | 0.592 | 94.0 | 0.594 | 94.0 | 0.596 | 94.0 | 0.598 | 94.1 | 0.600 | 94.1 | 0.602 | 94.1 | 0.604 | 94.1 |
| 0.600 | 94.0 | 0.602 | 94.0 | 0.604 | 94.0 | 0.606 | 94.0 | 0.608 | 94.1 | 0.610 | 94.1 | 0.612 | 94.1 | 0.614 | 94.1 |
| 0.610 | 94.0 | 0.612 | 94.0 | 0.614 | 94.0 | 0.616 | 94.0 | 0.618 | 94.1 | 0.620 | 94.1 | 0.622 | 94.1 | 0.624 | 94.1 |
| 0.620 | 94.0 | 0.622 | 94.0 | 0.624 | 94.0 | 0.626 | 94.0 | 0.628 | 94.1 | 0.630 | 94.1 | 0.632 | 94.1 | 0.634 | 94.1 |
| 0.630 | 94.0 | 0.632 | 94.0 | 0.634 | 94.0 | 0.636 | 94.0 | 0.638 | 94.1 | 0.640 | 94.1 | 0.642 | 94.1 | 0.644 | 94.1 |
| 0.640 | 94.0 | 0.642 | 94.0 | 0.644 | 94.0 | 0.646 | 94.0 | 0.648 | 94.1 | 0.650 | 94.1 | 0.652 | 94.1 | 0.654 | 94.1 |
| 0.650 | 94.0 | 0.652 | 94.0 | 0.654 | 94.0 | 0.656 | 94.0 | 0.658 | 94.1 | 0.660 | 94.1 | 0.662 | 94.1 | 0.664 | 94.1 |
| 0.660 | 94.0 | 0.662 | 94.0 | 0.664 | 94.0 | 0.666 | 94.0 | 0.668 | 94.1 | 0.670 | 94.1 | 0.672 | 94.1 | 0.674 | 94.1 |
| 0.670 | 94.0 | 0.672 | 94.0 | 0.674 | 94.0 | 0.676 | 94.0 | 0.678 | 94.1 | 0.680 | 94.1 | 0.682 | 94.1 | 0.684 | 94.1 |
| 0.680 | 94.0 | 0.682 | 94.0 | 0.684 | 94.0 | 0.686 | 94.0 | 0.688 | 94.1 | 0.690 | 94.1 | 0.692 | 94.1 | 0.694 | 94.1 |
| 0.690 | 94.0 | 0.692 | 94.0 | 0.694 | 94.0 | 0.696 | 94.0 | 0.698 | 94.1 | 0.700 | 94.1 | 0.702 | 94.1 | 0.704 | 94.1 |
| 0.700 | 94.0 | 0.702 | 94.0 | 0.704 | 94.0 | 0.706 | 94.0 | 0.708 | 94.1 | 0.710 | 94.1 | 0.712 | 94.1 | 0.714 | 94.1 |
| 0.710 | 94.0 | 0.712 | 94.0 | 0.714 | 94.0 | 0.716 | 94.0 | 0.718 | 94.1 | 0.720 | 94.1 | 0.722 | 94.1 | 0.724 | 94.1 |
| 0.720 | 94.0 | 0.722 | 94.0 | 0.724 | 94.0 | 0.726 | 94.0 | 0.728 | 94.1 | 0.730 | 94.1 | 0.732 | 94.1 | 0.734 | 94.1 |
| 0.730 | 94.0 | 0.732 | 94.0 | 0.734 | 94.0 | 0.736 | 94.0 | 0.738 | 94.1 | 0.740 | 94.1 | 0.742 | 94.1 | 0.744 | 94.1 |
| 0.740 | 94.0 | 0.742 | 94.0 | 0.744 | 94.0 | 0.746 | 94.0 | 0.748 | 94.1 | 0.750 | 94.1 | 0.752 | 94.1 | 0.754 | 94.1 |
| 0.750 | 94.0 | 0.752 | 94.0 | 0.754 | 94.0 | 0.756 | 94.0 | 0.758 | 94.1 | 0.760 | 94.1 | 0.762 | 94.1 | 0.764 | 94.1 |
| 0.760 | 94.0 | 0.762 | 94.0 | 0.764 | 94.0 | 0.766 | 94.0 | 0.768 | 94.1 | 0.770 | 94.1 | 0.772 | 94.1 | 0.774 | 94.1 |
| 0.770 | 94.0 | 0.772 | 94.0 | 0.774 | 94.0 | 0.776 | 94.0 | 0.778 | 94.1 | 0.780 | 94.1 | 0.782 | 94.1 | 0.784 | 94.1 |
| 0.780 | 94.0 | 0.782 | 94.0 | 0.784 | 94.0 | 0.786 | 94.0 | 0.788 | 94.1 | 0.790 | 94.1 | 0.792 | 94.1 | 0.794 | 94.1 |
| 0.790 | 94.0 | 0.792 | 94.0 | 0.794 | 94.0 | 0.796 | 94.0 | 0.798 | 94.1 | 0.800 | 94.1 | 0.802 | 94.1 | 0.804 | 94.1 |
| 0.800 | 94.0 | 0.802 | 94.0 | 0.804 | 94.0 | 0.806 | 94.0 | 0.808 | 94.1 | 0.810 | 94.1 | 0.812 | 94.1 | 0.814 | 94.1 |
| 0.810 | 94.0 | 0.812 | 94.0 | 0.814 | 94.0 | 0.816 | 94.0 | 0.818 | 94.1 | 0.820 | 94.1 | 0.822 | 94.1 | 0.824 | 94.1 |
| 0.820 | 94.0 | 0.822 | 94.0 | 0.824 | 94.0 | 0.826 | 94.0 | 0.828 | 94.1 | 0.830 | 94.1 | 0.832 | 94.1 | 0.834 | 94.1 |
| 0.830 | 94.0 | 0.832 | 94.0 | 0.834 | 94.0 | 0.836 | 94.0 | 0.838 | 94.1 | 0.840 | 94.1 | 0.842 | 94.1 | 0.844 | 94.1 |
| 0.840 | 94.0 | 0.842 | 94.0 | 0.844 | 94.0 | 0.846 | 94.0 | 0.848 | 94.1 | 0.850 | 94.1 | 0.852 | 94.1 | 0.854 | 94.1 |
| 0.850 | 94.0 | 0.852 | 94.0 | 0.854 | 94.0 | 0.856 | 94.0 | 0.858 | 94.1 | 0.860 | 94.1 | 0.862 | 94.1 | 0.864 | 94.1 |
| 0.860 | 94.0 | 0.862 | 94.0 | 0.864 | 94.0 | 0.866 | 94.0 | 0.868 | 94.1 | 0.870 | 94.1 | 0.872 | 94.1 | 0.874 | 94.1 |
| 0.870 | 94.0 | 0.872 | 94.0 | 0.874 | 94.0 | 0.876 | 94.0 | 0.878 | 94.1 | 0.880 | 94.1 | 0.882 | 94.1 | 0.884 | 94.1 |
| 0.880 | 94.0 | 0.882 | 94.0 | 0.884 | 94.0 | 0.886 | 94.0 | 0.888 | 94.1 | 0.890 | 94.1 | 0.892 | 94.1 | 0.894 | 94.1 |
| 0.890 | 94.0 | 0.892 | 94.0 | 0.894 | 94.0 | 0.896 | 94.0 | 0.898 | 94.1 | 0.900 | 94.1 | 0.902 | 94.1 | 0.904 | 94.1 |
| 0.900 | 94.0 | 0.902 | 94.0 | 0.904 | 94.0 | 0.906. | | | | | | | | | |

APDS CONTROL CARDS AND MESSAGES

JCR-ONTDATA3 ASP #3102

./CALCOMP#APOSCC

100 WLD0218999 LARRY FOGDALL 655-2954 SPAD PLOTS

110 TP 7TH 400 LHMCC

120 PL CALCOMP STANDARD INK PEN

122 START PLOT # 1 END PLOT # 999

200 STANDARD PAPER

400 1 LARRY FOGDALL

./END

2-53202R-A1